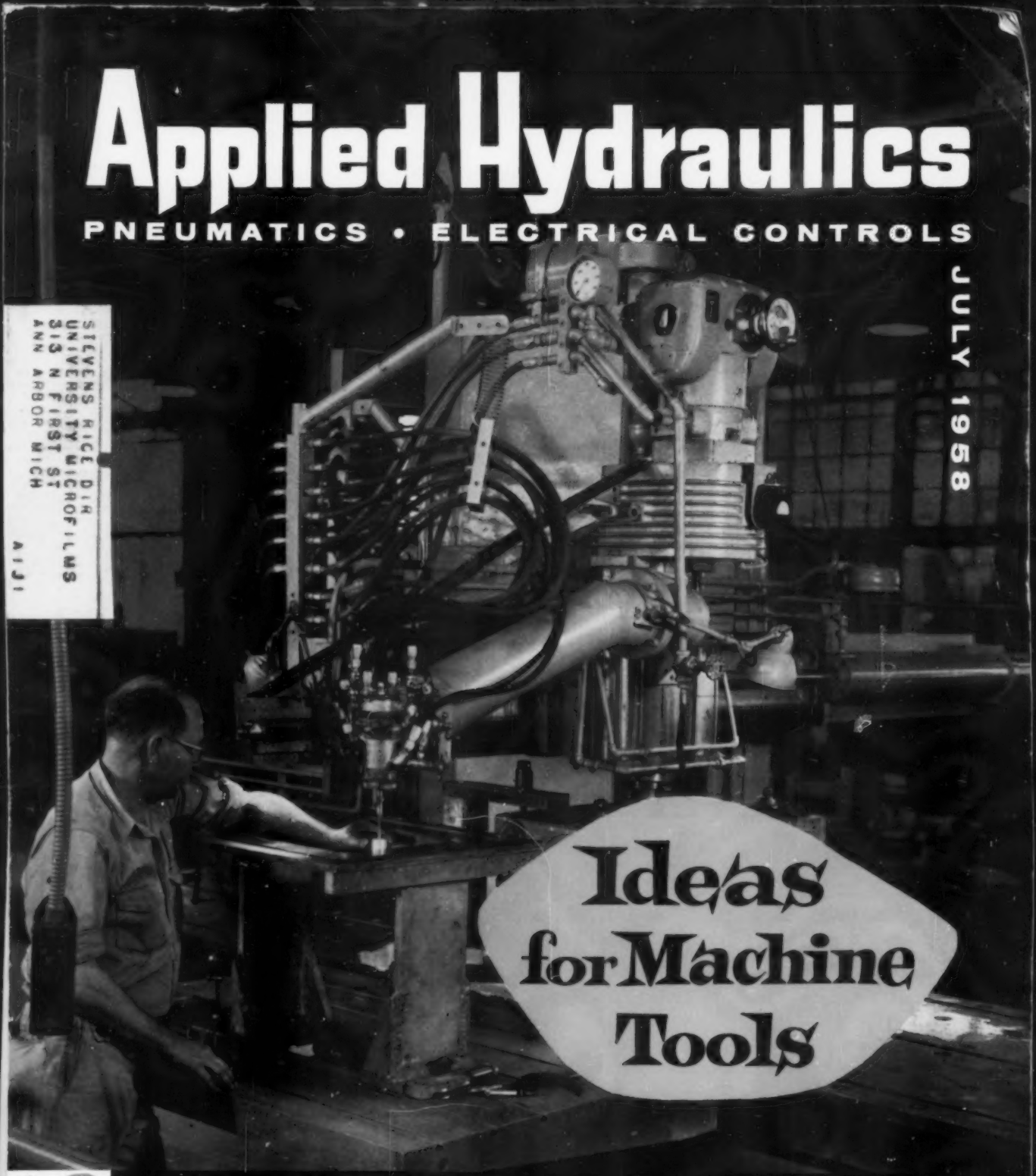
Applied Hydraulics

PNEUMATICS • ELECTRICAL CONTROLS

JULY 1958

STEVENS RICE DIR
UNIVERSITY MICROFILMS
313 N FIRST ST
ANN ARBOR MICH
A1J1



Ideas for Machine Tools

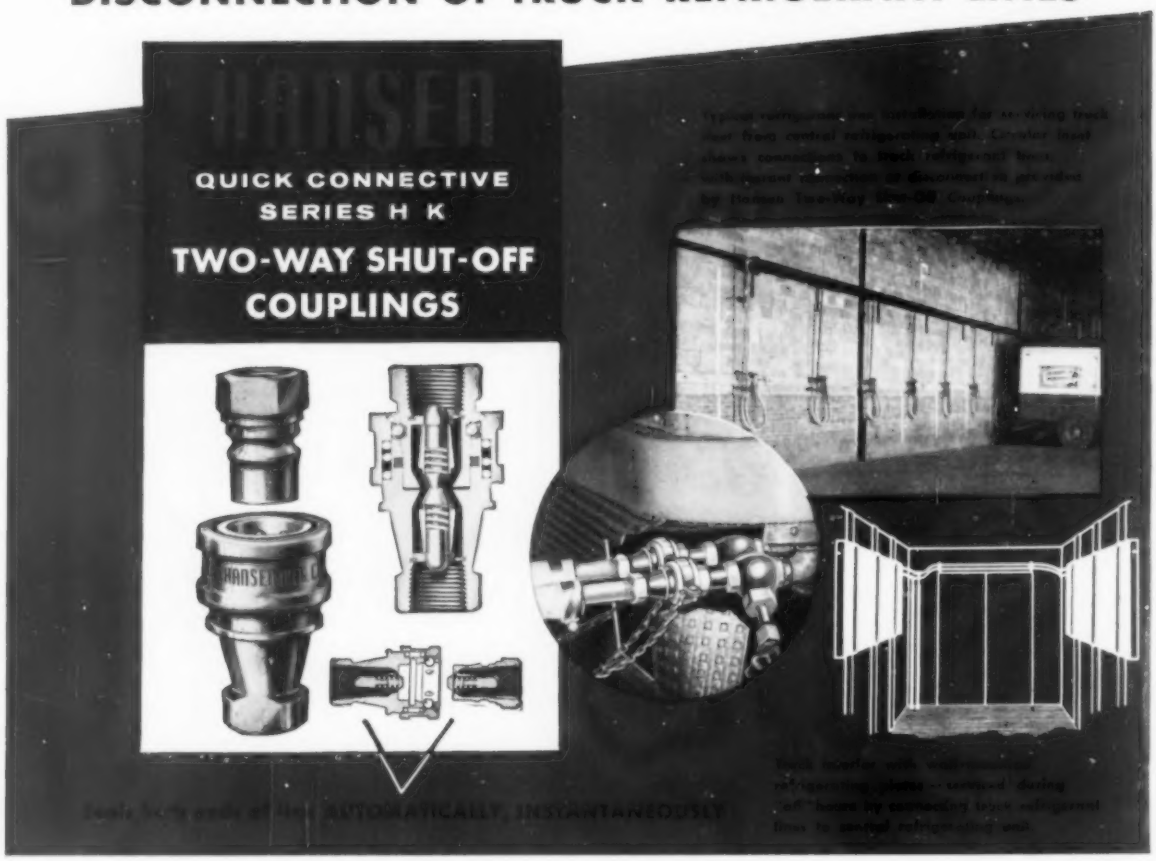
THE MAGAZINE OF FLUID POWER

AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

. . . read each month by 26,000 men who apply fluid power products to all types of machines and equipment

In the Dairy Industry, too—

TO PROVIDE INSTANT CONNECTION AND DISCONNECTION OF TRUCK REFRIGERANT LINES



On almost a countless variety of applications, in many types of industry, Hansen Couplings provide instant connection and disconnection of fluid lines, eliminate costly delays—save time, effort and money.

To connect a Hansen Two-Way Shut-Off Coupling, you just pull back the sleeve and push the Plug into the Socket. To disconnect, merely pull back sleeve. No tools required.

Similar valves in Socket and Plug shut off both ends of line when Coupling is disconnected . . . practically eliminate spilling of liquid or escape of gas at instant of disconnection.

Hansen Series HK Two-Way Shut-Off Couplings are available with female pipe thread connections from ⅛" to 1" inclusive. Available in brass or steel.

Also Straight-Through and One-Way Shut-Off Couplings. Write for Catalog.

REPRESENTATIVES IN PRINCIPAL CITIES

SINCE 1915

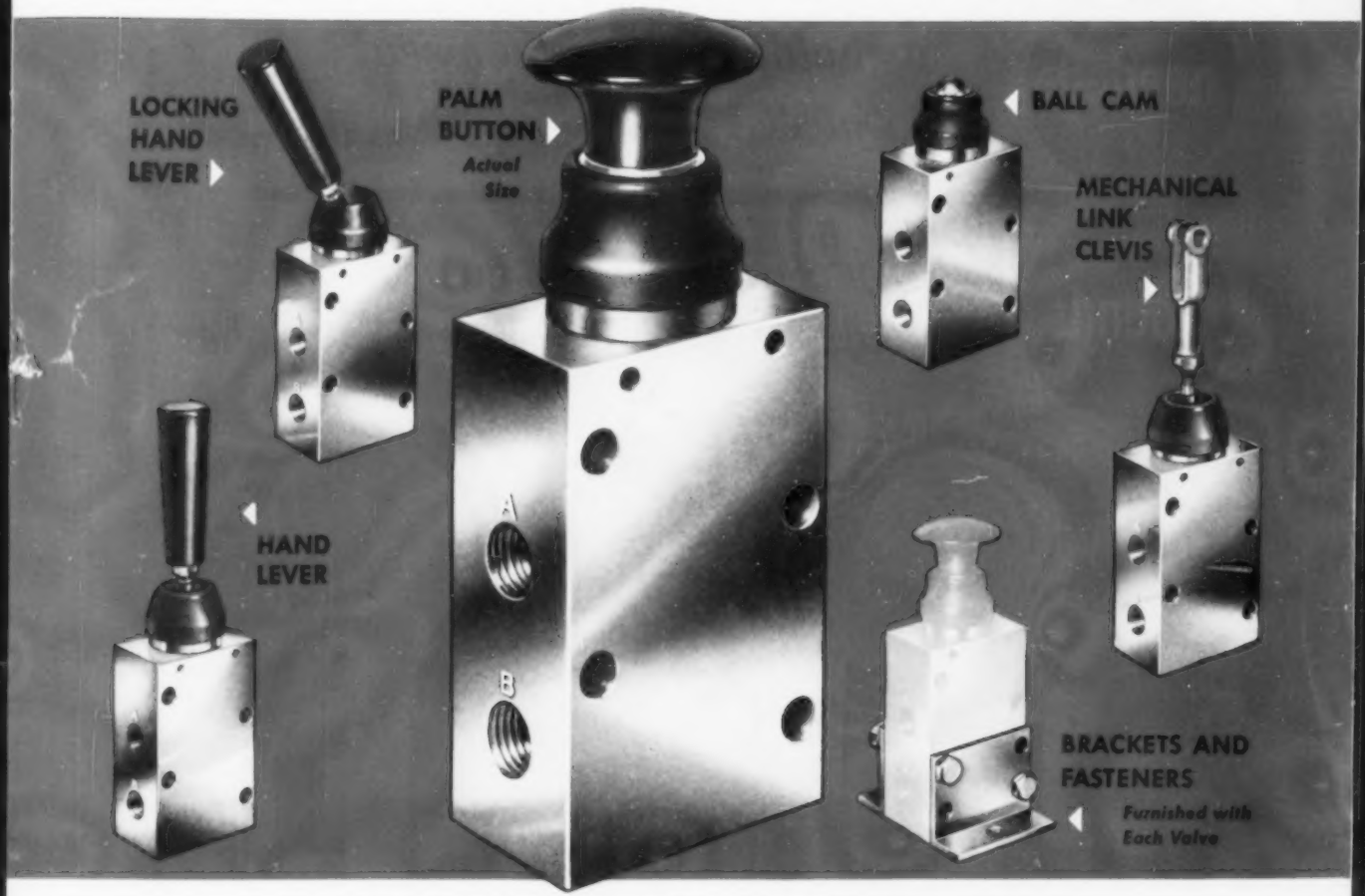
QUICK-CONNECTIVE FLUID LINE COUPLINGS

THE HANSEN MANUFACTURING COMPANY

4031 WEST 150th STREET • CLEVELAND 35, OHIO

CIRCLE 54 ON TIME-SAVER CARD

NEW HANNA FLO-PILOT VALVE has dirt-proof seal!



Hanna Flo-Pilot Valves are ¼" two- and three-way Pilot Valves for air operation to 150 psi. They are used for remote control of master valves, directional control of small single acting cylinders and for shut-off. Same valve can be used for two or three-way operation either normally open or normally closed to inlet pressure.

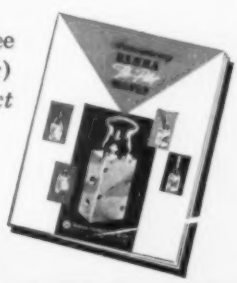
HANNA Flo-Pilot Valves will deliver years of dependable performance at a very low cost because they have built-in money-saving features. Every Hanna Flo-Pilot Valve is equipped with a synthetic boot which seals the valve stem and internal parts from harmful dirt and abrasive, thereby eliminating the most common cause of valve failure.

These protective boots, efficient "O" ring spool packing and nylon sleeves, are built into every Hanna Flo-Pilot Valve to save you money and assure leak-free operation even after millions of cycles.

The five actuating-heads—push button, ball cam, hand lever, locking hand lever and mechanical link clevis—are interchangeable in a matter of seconds. Spools can be changed just as quickly without disturbing the piping.

Corrosion resistant materials are used throughout. Flo-Pilot Valves have a simple, sturdy construction with anodized aluminum body, stainless steel and molded nylon parts. Valves can be conveniently mounted in any position and are furnished with brackets and fasteners. They are easy to operate, positive acting and have full capacity of ¼" orifices.

Ask your Hanna representative (see the yellow pages or Thomas Register) for complete information or *write direct for Catalog 262.*



Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES

1741 Elston Avenue • Chicago 22, Illinois

CIRCLE 52 ON TIME-SAVER CARD

needed: *a molded condenser seal to meet 10 rigid requirements*

found: *injection-molded cap engineered by minnesota rubber*

The Echlin Manufacturing Company of New Haven, Conn., needed a new end piece for their automotive condenser—one that would give good performance, improve appearance and cut costs.

They took their problem to the engineers of the Minnesota Rubber Company. The Echlin designers listed 10 requirements for the condenser cover. It should have high dielectric strength, a specified durometer, an absence of moisture absorption and oil resistance.

Dimensions were to be stable and constant, and no permanent deformation after compression could be tolerated. In addition, the seal had to retain its resilience at automotive engine temperatures, be physically attractive and bear the firm's name. And, it should be capable of being produced in quantity at a reasonable price.

Rubber injection molding techniques originated by Minnesota Rubber solved all these problems. Minnesota Rubber researchers developed a special Buna S compound that enabled them to completely fulfill specifications.

The result was a better product; one that looked better and bore the Echlin name. Also, the new condenser cover was a one-piece unit. It replaced a unit consisting of a screw machine part, a double lamination piece and a spring washer. Finally, this more satisfactory seal cost about eight percent less to manufacture!

The Minnesota Rubber Company, originators of modern rubber injection molding, can make similar improvements on components you may need. For full information, write to the department and address listed below. Order your 16-page brochure detailing Minnesota Rubber facilities at the same time.

Need low-cost prototypes? Another technique pioneered by Minnesota Rubber is KOTOKAST. This technique means rapid delivery of prototypes for experiment and development at a cost far below those made by standard processes. PROTOTYPES by KOTOKAST, another step forward by Minnesota Rubber Company.

Note: KOTOKAST is a trademark of the Minnesota Rubber Company.

MINNESOTA RUBBER COMPANY • 3630 Wooddale Avenue, Minneapolis 16, Minnesota, Department 103

for color in rubber
for parts of silicone rubber
for versatility in rubber
for applied product development

MINNESOTA MR RUBBER

Rainbow Rubber Division
Silicone Rubber Division
Plastics and Latex Division
Research and Development Division

CIRCLE 80 ON TIME-SAVER CARD

Applied Hydraulics

VOLUME 11/NUMBER 7

JULY 1958 THE MAGAZINE OF FLUID POWER

MACHINE TOOL FORUM 61

DRUM SWITCH CONTROLLED INDEXING 63
By Hy Cutler

TAILSTOCK SPEED AND FORCE CONTROL 64
By William Retz and Jacques Carpenter

POWER PACK FOR STEP DRILL 65
By Eric Hirvonen

SPINDLE DRIVE FOR MILLING MACHINE 66
By L. Braun

LATHE HYDRAULICS 67

PUMP METERS SMALL FLOW ON A HONING MACHINE 68
By Frank Reynolds, Jr.

SAFETY CIRCUIT FOR TRANSFER 69

AIR-OIL CLAMPS WON'T LET INCHWORM SQUIRM 70
By Edward Silver

HYDRAULICS MAKES TAPPING AUTOMATIC 72
By Harry Brown

BORING TOOL FEED 76

CYLINDER SPEED AND SHOCK 78
By Elmer F. Heiser

CIRCUIT DESIGN FOR A LARGE LATHE 80
By Z. C. Van Schwartz

BRAKE CONTROL FOR DRIVE MOTOR 82

CLUTCH OPERATION 84
By Karl Schubert

POSITIONING PISTONS ON AN AIR TRANSFER MACHINE 86
By Harry Satterthwaite

PLANER CHANGED TO PROFILE CUTTER 88

VALVE DESIGN PREVENTS CREEP 91
By Martin H. Benston

LIMIT SWITCHES SEQUENCE VERTICAL BROACH 92
by John A. Tartaglia and Walter H. Blackler

MULTIPLE SPINDLE DRILL FEEDS 94
By R. Johnson

AVIATION SECTION

CIRCUIT IDEAS FROM FRENCH JET TRANSPORT 100
By Robert Blanchet

CALCULATING SPRING CONSTANTS FOR HYDRAULIC CYLINDERS 104
By George R. Lay

DEPARTMENTS

8 ... Fluid Power Lines
13 ... Letters to the Editor
22 ... Future Events
30 ... Briefs
50 ... New Products
58 ... Useful Literature
128 ... Post Scripts of Industry
134 ... Market Place
135 ... Advertisers' Index

BPA

copyright 1958 by The Industrial Publishing Corporation

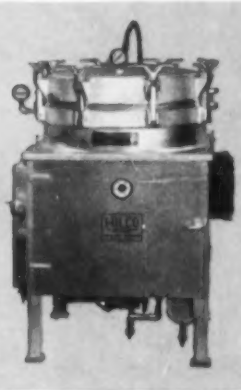
For SUPER Finishes you need SUPER Filtration...

FILTER

Furnished in capacities from 0.1 to 750 gpm. Various cartridges available for mineral and inhibited detergent oils.

OIL RECLAIMER

For complete oil reclaiming. Removes solids, acids and volatile impurities; moisture, solvents, gases, etc. from hydraulic fluids by heat-vacuum process.



That's what you get with

HILCO HYDRAULIC OIL FILTERS

You get complete maintenance of all hydraulic fluids. That means increased production, reduced maintenance cost, reduced oil cost and continuous equipment protection. Only HILCO offers such a wide range of filters and systems engineered for your needs.

Write today for HILCO Bulletin F-132

HILCO CUTS COSTS BECAUSE IT ELIMINATES...

- √ *VARNISH AND SLUDGE DEPOSITS*
- √ *FLUSHING AND MANUAL CLEANING*
- √ *FREQUENT OIL CHANGES*
- √ *ACCUMULATION OF DIRT*

THE HILLIARD CORPORATION

148 W. FOURTH ST. • ELMIRA, NEW YORK

• IN CANADA •

UPTON-BRADEEN-JAMES, LTD.

890 YONGE STREET, TORONTO 8760 VERVILLE STREET, MONTREAL

Applied Hydraulics

THE MAGAZINE OF FLUID POWER

Published monthly by
THE INDUSTRIAL PUBLISHING CORP.
812 Huron Road, Cleveland 15, Ohio

IRVING B. HEXTER ..... President
LESTER P. AURBACH ..... Executive Vice-President
EDWIN M. JOSEPH ..... Vice-President
LEE HAAS ..... Vice-President

STAFF

PAUL ROLNICK ..... Editor and Publishing Director
ALLAN E. MORRIS ..... Executive Editor
KEITH A. CARLSON ..... Associate Editor
BERT BENKENDORF ..... Associate Editor
JACK LOWERY ..... Assistant Editor
SCHOLER BANGS ..... Western Editor, Los Angeles Office
JOHN A. LANKESTER, A.R.Ae.S. ..... European Editor
ALARIC MAUSSER ..... Art Director
N. G. KISER ..... Circulation Director
ALAN KICHLER ..... General Mgr. Franchised-Dealer Dept.
R. V. STARKS ..... Mgr. Reader Service Dept.

SALES OFFICES

CLEVELAND 15 ..... SUperior 1-9622
R. D. SHATTUCK

NEW YORK 17 ..... MUrray Hill 7-3420
LEE HAAS, Vice-President
V. R. STEIN, Administrative Assistant
RONALD ROSE, Eastern Representative
60 E. 42nd St.—Room 836

CHICAGO 11 ..... WHitehall 3-1655-56-57
CHARLES F. GEYER, Manager
S. R. TRACY
520 N. Michigan Ave.—Room 704

LOS ANGELES 57 ..... DUnkirk 7-5104
ALAN T. CAZIER, Manager
WILLIAM MILLS
Room 8, Granada Building
672 South Lafayette Park Place

LONDON S.W.1 ..... Victoria 2608
JOHN A. LANKESTER, A.R.Ae.S. ..... Manager
31 Palace St., Westminster

SUBSCRIPTION in United States and possessions—$5.00 per year; Canada—$6.00 per year; Foreign—$7.00 per year, except United Kingdom. United Kingdom subscription £ 3.00 per year, payable in Sterling to our London Office. Single copy price, this issue, $.50. All subscriptions subject to individual acceptance by the publisher.

AFFILIATED PUBLICATIONS: REFRIGERATION & AIR CONDITIONING BUSINESS, PRECISION METAL MOLDING, FLOW, INDUSTRY & WELDING, OCCUPATIONAL HAZARDS, MODERN OFFICE PROCEDURES, AERONAUTICAL PROCUREMENT, MATERIAL HANDLING ILLUSTRATED, and WELDING ILLUSTRATED. Member, Business Publications Audit of Circulation, Inc.
Accepted as controlled circulation publication at Pontiac, Illinois. Please return 3579 forms to 812 Huron Road, Cleveland 15, Ohio.

Useful Literature

NEW CATALOG DESCRIBES ANCHOR REUSABLE COUPLINGS

Containing a wealth of specifications and informative engineering data, Anchor's new catalog No. 302, just off the press, should prove extremely helpful to any designer or user of hydraulic equipment, or any other equipment that requires the transmission of fluid or gas under pressure.

In it complete descriptions and specifications are given for the several styles of reusable couplings produced by Anchor and the various types of hose that can be used with the couplings to make up completed hose assemblies.

Prominent among the coupling styles shown in this catalog is the popular and widely used Duloc reusable coupling for medium and low pressure use with Anchor QW Hose. One of the outstanding features of this coupling is the speed and convenience with which it can be attached to the hose.

QW Hose is a one-cotton, one-wire and one-cotton braid hose; the outer cotton braid, impregnated with synthetic rubber, serves as an abrasion resisting cover. This hose is also available, as Style QWR, with a thin rubber cover over the outer cotton braid. Both styles are available from 3/16" to 1-13/16" I.D., 3000 to 350 P.S.I. Max. Working Pressure.

Other reusable couplings described in this new catalog are used for Style C high pressure 2-wire braid hydraulic hose, Style F medium and low pressure one-wire braid hydraulic hose, Style HR HI-BURST 2-rayon braid hose and Style R Standard 2-rayon braid hose.

Specifications are also given for the complete line of Anchor Reusable Clamp-Type Couplings, available for high, medium and low pressure hose from 1/4" to 2" I. D.

Copies of this new catalog are now available upon request. Write to Anchor Coupling Co. Inc., 354 No. Fourth St., Libertyville, Ill.

Ask for Anchor Catalog No. 302.

ENGINEERED
to serve you better — longer!

ANCHOR®

Hose Assemblies, Couplings and Fittings!

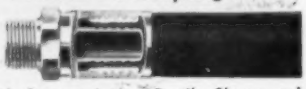
The failure of a coupling or hose connection in a hydraulic line, with the ensuing delay, loss of time or production, can cost many times more than the coupling itself.

That is why such stringent quality standards, in both materials and workmanship, prevail at Anchor. Frequent inspections and tests are made in production to enforce these standards to the point where they are accepted Anchor factory practice.

Whatever your purchase from Anchor, hose assemblies, couplings, or fittings, they must conform to these high standards. Because of this, Anchor products have a reputation for quality and for trouble-free performance in the field.

When you specify Anchor for your hydraulic hose components and equipment you are selecting the line that is unsurpassed for dependability, long service and efficiency. Don't gamble with costly breakdowns and delays—specify Anchor always!

ANCHOR
Pressed On Couplings



For High Pressure-Anchor Ductile Sleeve and Sleeveless Couplings for 2, 3 and 4 Wire Braid and 6 ply Spiral Wire Wrap Hose, 3/16" to 2" I.D., 7000 P.S.I. to 750 P.S.I. Max. Work. Pres.

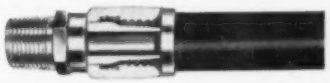
Medium and Low Pressure Assemblies

For One Wire Braid Hose, 3/16" to 2" I.D., 3000 to 375 P.S.I. Max. Work. Pres.

For "Hi-Burst" 2-Rayon Braid Hose, 1/4" to 1 1/4" I.D., 1250 to 375 P.S.I. Max. Work. Pres.

ANCHOR
Reusable Couplings

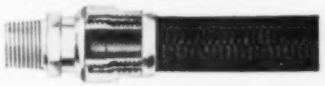
For High and Medium Pressure



For Two Wire Braid Hose, 1/4" to 1" I.D., from 5000 P.S.I. to 1875 P.S.I. Max. Work. Pres.

For One Wire Braid Hose, 1/4" to 3/4" I.D., from 2750 P.S.I. to 1250 P.S.I. Max. Work. Pres.

For Medium and Low Pressure



Anchor "Duloc" Couplings, for Style QW 1-Cotton, 1-Wire Braid, Cotton Braid Covered Hose with synthetic inner tube and Style QWR, same as QW but with thin rubber outer cover, 3/16" to 1 13/16" I.D., 3000 P.S.I. to 350 P.S.I. Max. Work. Pres.

For Medium and Low Pressure

For "Hi-Burst" 2 Rayon Braid Hose, 1/4" to 3/4" I.D., 1250 P.S.I. to 750 P.S.I. Max. Work. Pres.

For High, Medium and Low Pressure

Anchor Clamp Type Couplings for 2 Wire and 3 Wire Braid High Pressure Hose from 1/4" to 2" I.D. and 5000 to 750 P.S.I. Max. Work. Pres. and 1 Wire Braid Medium Pressure Hose, 1/4" to 2" I.D., from 2750 P.S.I. to 375 P.S.I. Max. Work. Pres. Also for Spiral Wire Suction Hose, 3/4" to 2" I.D., 300 P.S.I. to 100 P.S.I. Max. Work. Pres. and "Hi-Burst" 2-Rayon Braid Hose, 1/2" to 1" I.D., 1000 P.S.I. to 550 P.S.I. Max. Work. Pres.

ANCHOR
Bent Tube Assemblies

Made to suit your individual requirements and specifications.

ANCHOR
Fittings, Adapters, Adapter Unions and SAE Boss "O"-Ring Fittings

90° Male Adapter Union | 45° "O"-Ring Straight-Thread Adapter | 45° Street Elbow

Andy Anchor says:

"The Anchor Products shown here represent only a small portion of the complete Anchor line."

WRITE FOR CONDENSED CATALOG No. 575

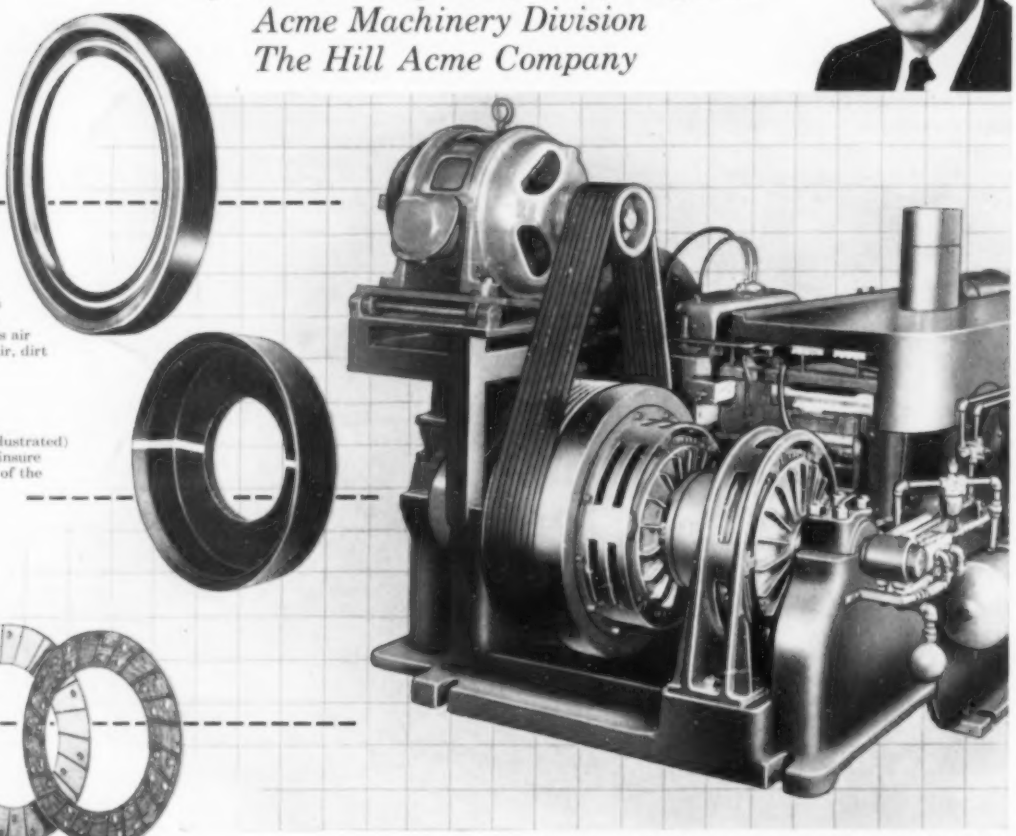
ANCHOR COUPLING CO., INC.

354 No. Fourth Street — Libertyville, Ill.

Branch Offices—Dallas, Texas—Plymouth, Michigan

"Customer satisfaction hit a new high when we redesigned Acme forging machines with J-M Packings and Friction Materials,"

says M. W. Lamprecht, Chief Engineer
Acme Machinery Division
The Hill Acme Company



J-M Clipper Seals protect the Acme Forging Machine's air distributor from air, dirt and abrasives.

J-M "A" Cups (illustrated) and Hat Gaskets insure smooth operation of the air cylinder.

J-M Clutch Facings (illustrated) and Brake Linings play integral parts in the Acme Forging Machine's cushion drive mechanism.

Acme Forging Machines are widely used by metalworking plants all over the world. They are made by Hill Acme Co., pioneers and leaders in construction and design of modern forging machines.

J-M products defy extreme thermal and mechanical shock for dependable performance and long life

In terms of thermal and mechanical shock and the constant presence of dirt, chips and other abrasives, Acme Forging Machines provide one of the most rugged tests ever devised for packings and friction materials. In more than 20 years of service, Johns-Manville products have achieved an enviable record with Acme users. Performance has been more than satisfactory in every way and replacement has been held to the minimum.

Johns-Manville makes a complete line of packings, gaskets, asbestos textiles, brake linings, clutch facings, transmission bands and industrial friction materials. Chances are one or more of these products may provide the answer to your design problems. For further information call your local J-M sales office or write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

JOHNS-MANVILLE

JOHNS-MANVILLE JM PRODUCTS

. . . Fluid Power news

REPORT No. 11,702

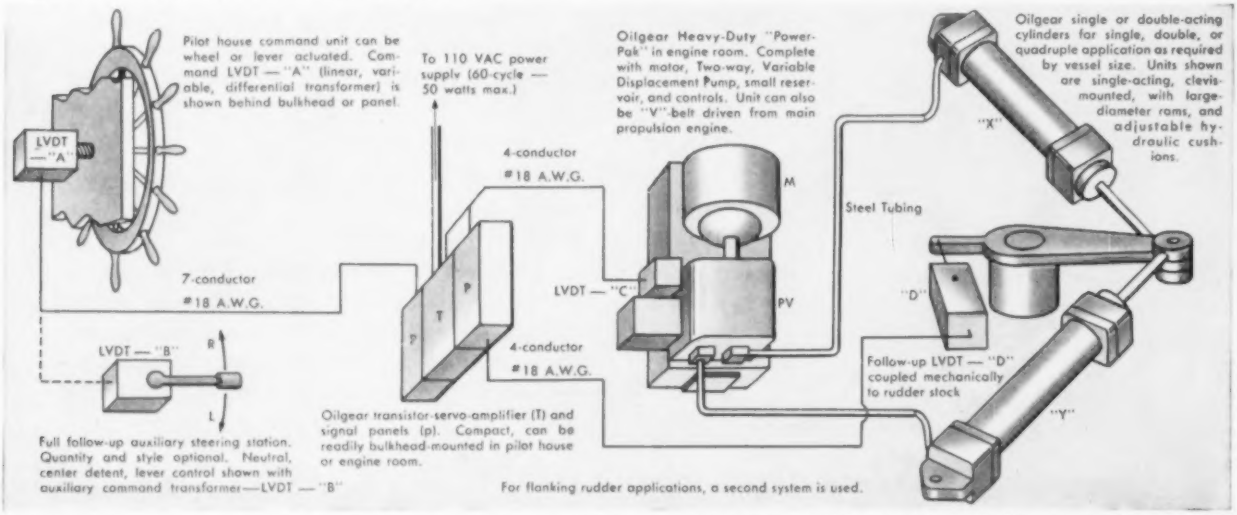
NEW MARINE STEERING CONCEPT

From Oilgear Application-Engineering Files

HOW OILGEAR APPLICATION-ENGINEERING AIDED CREATION OF MODERN MARINE STEERING GEAR

CUSTOMER: *A long-established Marine Engineering Company (name on request)*

DATA: This company's technical staff concluded that marine steering gear could be modernized instead of merely being made larger and heavier. A design program to incorporate new electric and hydraulic developments had the following basic objectives. 1: Extreme flexibility for normal application on all vessels requiring power steering. 2: New economy in system weight, size, and installed cost. 3: Simplicity, accuracy, reliability. 4: Full follow-up pilot house and auxiliary station control of rudder movement, speed, position. 5: Eliminate make-and-break, or sliding electrical contacts, relays, vacuum tubes, solenoid valves, heavy shafting, gears, racks, and linkage in the control system. Smooth, positively indexed, rate responsive, stepless rudder movement control that is noise, shock, vibration, and pulsation-free. 7: Compatible with gyro-compass, automatic steering.


Pilot house command unit can be wheel or lever actuated. Command LVDT — "A" (linear, variable, differential transformer) is shown behind bulkhead or panel.
LVDT — "A"
To 110 VAC power supply (60-cycle — 50 watts max.)
Oilgear Heavy-Duty "Power-Pak" in engine room. Complete with motor, Two-way, Variable Displacement Pump, small reservoir, and controls. Unit can also be "V"-belt driven from main propulsion engine.
Oilgear single or double-acting cylinders for single, double, or quadruple application as required by vessel size. Units shown are single-acting, clevis-mounted, with large-diameter rams, and adjustable hydraulic cushions.
4-conductor #18 A.W.G.
7-conductor #18 A.W.G.
LVDT — "B"
R
L
LVDT — "C"
M
PV
P
T
"X"
Steel Tubing
"D"
"Y"
4-conductor #18 A.W.G.
Follow-up LVDT — "D" coupled mechanically to rudder stock
Full follow-up auxiliary steering station. Quantity and style optional. Neutral, center detent, lever control shown with auxiliary command transformer—LVDT — "B"
Oilgear transistor-servo-amplifier (T) and signal panels (p). Compact, can be readily bulkhead-mounted in pilot house or engine room.
For flanking rudder applications, a second system is used.

SOLUTION: Above schematic symbolizes an Oilgear Fluid Powered, electrically controlled, marine steering system utilizing the newest electric-hydraulic developments. *Actual installations using this new Oilgear "electro-feedback-hydraulic-servo-control system" have exceeded ALL of the customer's original engineering objectives* . . . proof of Oilgear's cooperation and teamwork to help solve design engineer's problems. Oilgear Heavy-Duty "Power-Paks" are complete, ready-to-install power units in sizes and types to meet every marine need. No auxiliary valves, pumps, controls, reservoirs, or "plumbing" are required. Oilgear "Custom-Quality" single and double-acting cylinders can furnish the "muscle" to control any type vessel. Oilgear ServoControl Division's rugged, compact transistor-servo-amplifier and control system is further proof of Oilgear progressive, pioneering, engineering service. Connections between the amplifier and signal generators can be made by any competent electrician.

In every industry, manufacturers and users recognize and trust the name "Oilgear" for dependable, lowest-cost-per-year operation.

For similar practical solutions to YOUR linear or rotary Controlled-Motion problems, call the factory-trained Oilgear Application-Engineer in your vicinity. Or write, stating your specific requirements, directly to . . .

THE OILGEAR COMPANY

Application-Engineered Controlled Motion Systems

1564 WEST PIERCE STREET • MILWAUKEE 4, WISCONSIN

OPERATION: LVDT units (A, B, C, D) are actually coils with a core or slug moved axially in the coil airgap. When core is at central position there is a "null" signal. Maximum signal is emitted at maximum limits of travel — either "in" or "out." Movement of wheel or steering lever displaces core of command LVDT (A or B), producing a signal that is compared in transistor amplifier (T) with the signal from rudder stock coupled LVDT (D). Resulting difference between these two signals is called the "error" signal — built up to usable current strength by amplifier (T). Amplified signal is applied to an AC torque motor on Oilgear Two-way, Variable Displacement Pump (PV), imparting movement in amount and direction as ordered to a hydraulic servo valve — stroking pump (PV) to supply ordered direction and volume to rudder actuating cylinders (X, Y). As rudder moves, coupled LVDT (D) is displaced to reduce error signal to zero — at which point the cycle is complete. During this cycle, pump LVDT (C) has also been sending its signal to the amplifier for comparison, insuring that pump output is always under error signal control. Rapid motion of the command wheel or lever generates a large error signal, resulting in full rudder speed. Similarly, a slow command movement results in a slow rudder speed.

RIGHT: Oilgear Size 3, Heavy-Duty "Power-Pak" with Two-way, Variable Displacement Pump, motor, reservoir and controls . . . "as shipped," ready for installation with an "electro-feedback" system described above. This unit is now in use on a new 144' x 55' x 5' draft ferry boat of 483-ton displacement.

Similar Oilgear Systems are being used to control motion in all industry.

FLUID POWER LINES

about applied hydraulics

WINDOW GAZING . . . At this very moment, all over the United States, men are gazing out windows. In bustling New York they're looking down forty stories at sacked torsos crossing 5th Avenue. In Chicago they're watching lunchers and loafers in Grant Park. In Los Angeles they see a white vapor trail drawn on a clear blue sky by an invisible airplane. These men are engineers, and in spite of their apparent inactivity, they're working very hard. They're solving problems in speeds and forces, visualizing mechanisms, and generating new ideas for better products.

While we recognize the value of standing off and taking the long look, we also believe it helps to find out how others solved similar problems. So in this issue we've concentrated on *Design Ideas for Machine Tools.* There's a lot of engineering know-how represented in these pages: circuit schemes, special designs, mechanical arrangements. Shop through these short articles beginning on page 63, you may find something you need.

WHEN IS A VALVE? . . . When New Britain-Gridley Div. designed a powered tailstock for their "GF" copying lathe, they needed a sequence of fast traverse, high force, stop, and then low force. To get it, they used a "sequence" valve in an unusual way to change from a differential circuit to a conventional circut, and to control relief valve setting. For the design details see *Tailstock Speed and Force Control.*

USING THE SQUEAL . . . Expanding honing stones hydraulically takes very fine control of flow at rates of 1 or 2 cipm. That's too low for flow control valves, so Barnes Drill designed a metering pump for this job. It controls speed of the cylinder which actuates the stones. For set up, the operator bypasses the pump for fast expansion of the stones. When he hears the characteristic squeal of honing, he connects in the metering pump for automatic control. See page 68 for the whole story.

OOH LA LA! . . . Leave it to the French to design the most chic jet transport aloft in Sud Aviation's *Caravelle.* Mounting the engines on the fuselage near the tail, cuts down cabin noise and gives it a long sleek look. The more prosaic part of its design includes hydraulic systems for the control surface actuators, artificial "feel" system, and flap position-follow-up. They're described in this month's Aviation Section.

MEET JACK LOWERY . . . He's joined APPLIED HYDRAULICS' staff as assistant editor. With a Bachelor of Mechanical Engineering Degree from Fenn College, Jack has had 13 years experience in industrial sales including application of hydraulic and pneumatic components. During the war, Lt. Lowery spent 4 years as Engineering Officer aboard a destroyer where his responsibilities included hydraulic systems for ship steering, deck winches, and fire control. He will spend much of his time with AH covering pneumatic applications.

Jack Lowery

What! Painting or Etching to Suit the Occasion!

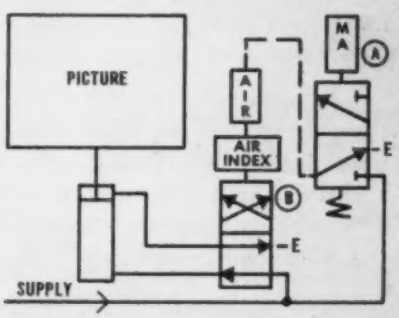
This "one knob picture control" is unlikely we will agree, but . . .

Art tastes do vary. The boys may not wish to share theirs with the spouses . . . in fact they may not *dare* to. And it might even call for a quick disappearing act for the little lady who is wearing little more than a blush. Unlikely as this device is, it would efficiently accomplish this neat scene change for such "art lovers." In the meantime, it gives us a chance to show something new. How one valve can now extend a double acting cylinder, letting it remain extended when the valve is released, then retract the cylinder at the next actuation by using the new Ross momentary air index adaptor.

The Ross air indexing momentary has hundreds of serious uses

Now, a standard Ross Skyline valve, either solenoid or air operated can include this momentary air index adaptor. Then the first actuation will send the valve one way and it will stay in that position, even when the actuator releases. The next stroke reverses the valve, again it stays after actuator release, etc.

See your Ross representative for application information.



SEQUENCE OF OPERATION

1. Valve (A) is manually actuated, valve (B) reverses and stays put, keeping pressure on one side of double-acting cylinder.
2. When Valve (A) is manually actuated again, valve (B) reverses and stays put, keeping pressure on opposite side of double-acting cylinder.

Ross OPERATING VALVE CO.

105 East Golden Gate • Detroit 3, Michigan

CIRCLE 136 ON TIME-SAVER CARD

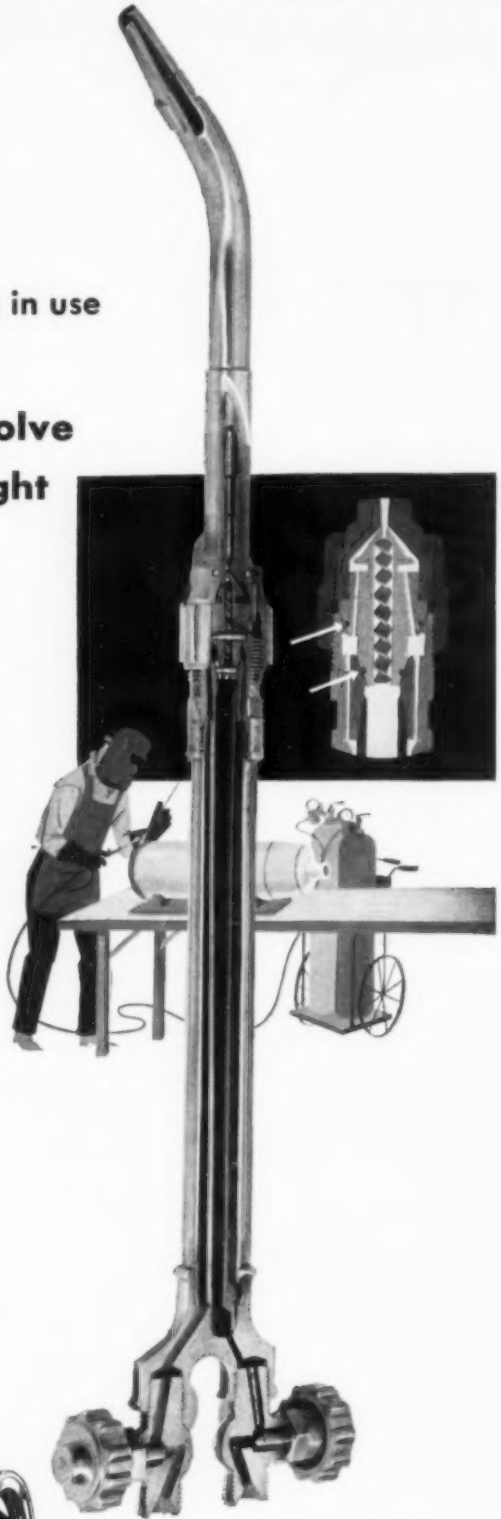
Ozone deterioration

Continuing stress

Gas leakage

Rough handling in use

New National Hypalon O-rings solve these problems; insure a hand-tight gas seal in Victor Torches



As static seals, commercial Buna N O-rings performed satisfactorily in Victor welding torches — *when the rings were new.*

However, ordinary O-rings age fast in welding torches. They receive rough treatment when welders change nozzles; nozzles are often dropped on the ground to lie there until needed again. Severe ozone deterioration is experienced. Continuing stress, although mild, impairs O-ring elasticity. Rings on welding nozzles are sometimes subjected to long shelf life.

National Seal engineers developed a new O-ring compound, National Hypalon L-11, which not only withstands rough handling, ozone deterioration and stress but exhibits many times the shelf life of Buna N compounds previously used. Today, National Hypalon is standard at Victor.

Special compounding to meet unusual conditions is a basic part of National's complete O-ring engineering service — service available from National Field Engineers in major cities nationwide.

NATIONAL SEAL
Division, Federal-Mogul-Bower Bearings, Inc.
General Offices: Redwood City, California
Plants: Van Wert, Ohio, Redwood City and Downey, California

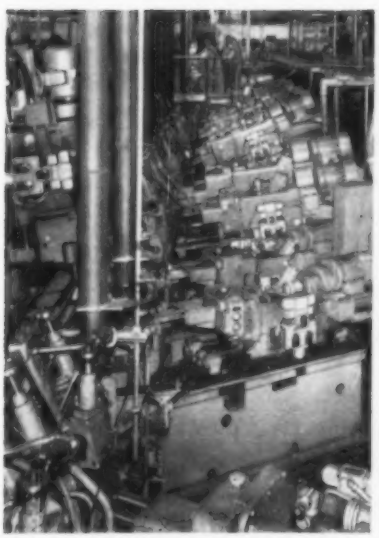
4374

CIRCLE 84 ON TIME-SAVER CARD

At The Ford Motor Company's Cleveland Engine Plant No. 1

AMERICAN BROACH & MACHINE DIVISION
BARNES DRILL COMPANY
BUHR MACHINE TOOL COMPANY
THE CROSS COMPANY
EX-CELL-O CORPORATION
EXPERT WELDING MACHINE CO.
THE FOOTE-BURT COMPANY
GREENLEE BROS. & CO.
THE HARTFORD SPECIAL MACHINERY CO.
THE HEALD MACHINE COMPANY
HOLCROFT & COMPANY
INDUSTRIAL METAL PRODUCTS CORPORATION
THE INGERSOLL MILLING MACHINE COMPANY
THE LAPOINTE MACHINE TOOL COMPANY
LANDIS TOOL COMPANY
THE R. K. LE BLOND MACHINE TOOL CO.
McDONNELL MACHINE TOOL, INC.
MICHIGAN TOOL COMPANY
MICROMATIC HONE CORPORATION
THE MORRIS MACHINE TOOL CO.
THE MOTCH & MERRYWEATHER MACHINERY CO.
NATIONAL AUTOMATIC TOOL CO.
SNYDER TOOL & ENGINEERING CO.
SUNDSTRAND MACHINE TOOL CO.
WICKES MACHINE TOOL DIVISION
WILSON AUTOMATION COMPANY

VICKERS® HYDRAULICS
HELPS CUT MAINTENANCE COSTS
of Machinery Supplied by These Companies to This Modern Automated Plant



Typical transfer line installation shows ample use of Vickers hydraulics for actuation and control of automated operations.

High production is convincing proof of equipment reliability—one of many reasons why Vickers Hydraulics is engineered into equipment for modern automated production plants.

The above manufacturers find that Vickers Hydraulics simplifies installation and minimizes piping—benefits also enjoyed by the user. Vickers highly efficient pumps produce significant power savings . . . Vickers controls help minimize scrap and rework by providing precise positioning for machining and other in-process operations. Component dependability helps provide extended periods of uninterrupted production. Demountable unit construction simplifies on-the-job repairs and helps reduce downtime.

The Vickers complete line of components is ideally suited to hydraulic equipment standardization and interchangeability, reducing replacement inventory. Our application engineers will supply detailed information without obligation. General Catalog 5001B is available upon request.

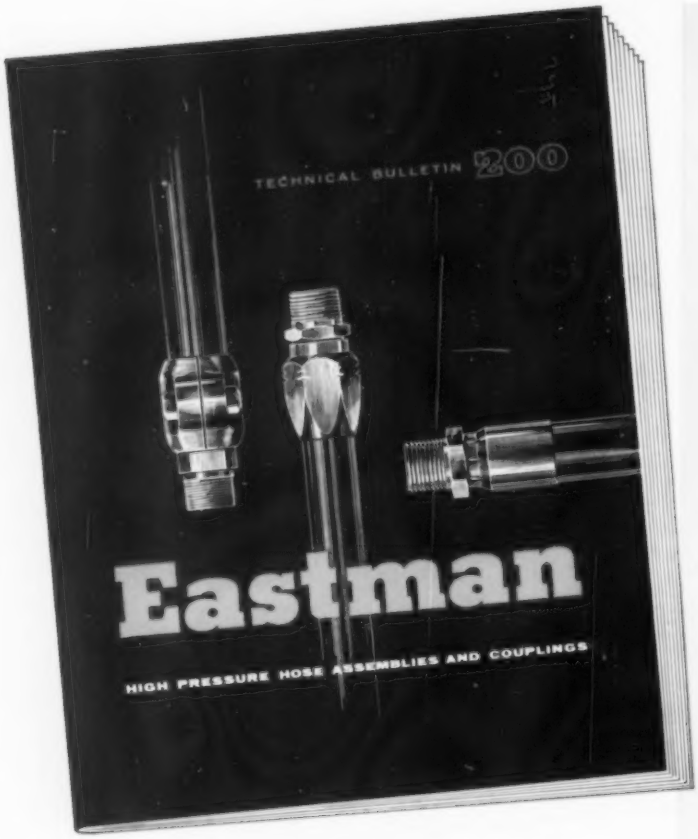
7996

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Machinery Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
Department 1474 • Detroit 32, Michigan

Application Engineering Offices: ATLANTA • CHICAGO CINCINNATI • CLEVELAND • DETROIT • GRAND RAPIDS • HOUSTON • LOS ANGELES AREA (El Segundo) MINNEAPOLIS • NEW YORK AREA (Springfield, N.J.) PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. • ROCHESTER • ROCKFORD SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS TULSA • WORCESTER • Factories also in: AUSTRALIA, ENGLAND, JAPAN AND GERMANY • In Canada: Vickers-Sperry of Canada, Ltd., Toronto, Montreal and Vancouver

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

CIRCLE 125 ON TIME-SAVER CARD



CONVENIENTLY ARRANGED TO HELP YOU MEET THE INCREASING DEMAND FOR HIGHER PRESSURES

Here's an entirely new service concept in catalog arrangement. It is designed to assist Engineers and Purchasing Agents in specifying Multi-Braid Hydraulic Hose and Tube Assemblies to meet the demand for increasing pressure requirements. With pressure as a primary consideration—the right assembly can be selected for the specific equipment on which it is to be used.

Nine major sections are devoted to assemblies suited to all types of high pressure hydraulic applications—complete with tables and specifications, including easy to read dimensional cross section drawings.

Include this new catalog in your files to make it easier to specify the proper assemblies.

Write for Your Copy Today!

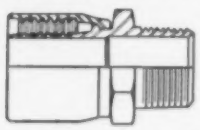
Eastman *first in the field* **MANUFACTURING COMPANY**
Dept. AH-7, MANITOWOC, WISCONSIN

SAFEGUARDING AMERICA'S LIFELINES OF MOBILE POWER

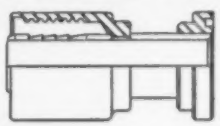
AN INSIDE LOOK AT A *NEW BOOK*

Eastman's new Technical Bulletin offers a new standard in simplified arrangement—for your convenience in specifying—according to your pressure requirements.

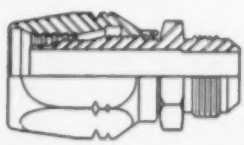
Swivel "O" Ring Male Couplings are available in 45° and 90° angles. Specifications on Page 13.



Permanently Attached Couplings for 2-wire braid hose. Specifications and Details on Page 10.

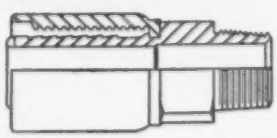


Permanently Attached Flange Head Couplings and Inserts from 0° to 90°. See complete list on Page 21.



2-Piece Reusable Couplings for all high pressure hose. Used for pressures up to 5000 lbs. See Page 25.

Swivel Male Tube Nut "O" Ring Assembly used on formed tubing—described on Page 30.



Permanently Attached Couplings for **Extreme** High Pressures up to 7000 lbs. working pressure, Page 12.

CIRCLE 35 ON TIME-SAVER CARD

LETTERS to the editor

Address your letters to: Editor, APPLIED HYDRAULICS MAGAZINE, 812 Huron Rd., Cleveland 15, Ohio.

"DSTLLD WRTNG"

In the May issue's Fluid Power Lines AH editors invited readers to try their hand at Distilled Writing. (An insert in this issue tells you more about D.W.) We asked readers to send in distilled versions of the first two paragraphs of the lead article which told about a new pump development. Our thanks to engineers who joined in this game. A genuine editor's blue pencil has been sent to each of you. Here is one of the examples of double distilled writing:

TO THE EDITOR:

"Navy pump promises flow and power superiority, Smaller, lighter; double acting design.

Active elements; rotor; five hub segments; spacer; matching side plates. Pins and blocks in rotor spaces. Blocks overlap segments to seal".

K. M. GEBEL
Hydraulic Engineering
Landis Tool Company
Waynesboro, Pa.

Basic Electrical Circuitry

TO THE EDITOR:

Because hydraulics and electrical circuits are closely related, I would like a complete book on electrical circuitry as applied to machine tools. I do not wish to become an electrician, but I would like to be able to talk their language and read their circuit prints with them. Most important of all, the hydraulic troubleshooters in our department, after training with a book of this type could work more closely and efficiently with the electricians.

We are using for training purposes articles written by APPLIED HYDRAULICS' executive editor, Allan Morris. They are: "Electrical Components for Fluid Power

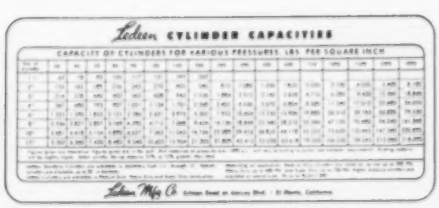
Continued on page 16

NEED A CYLINDER?

Ledeen Stocks Them or Builds Them to Fit Almost Any Application

For normal applications requiring standard cylinders or for those unusual applications where a special cylinder is needed, see Ledeen.

Let us know the type of job to be done and how much cylinder power you need. Send for this handy cylinder capacity chart.



Write for Bulletin 500

VALVES • CYLINDERS
VALVE ACTUATORS
AIR-HYDRAULIC PUMPS
AND TEST STANDS

Ledeen Mfg. Co.
3332 North Gilman Road
El Monte, California

Alex Dreier and Walt Behlen, President of Behlen Manufacturing Company, demonstrate the Behlen Powr-Steer to engineers attending the 1958 Design Engineering Show. It is mounted anywhere along the steering shaft and has both right hand and left hand operation. Dimensions: 15½"x4½"x6-9/16".

ALEX DREIER, NBC's "Man On The Go" Reports On The Behlen Hydraulic Servo Mechanism

Part of my job is keeping up with unusual developments in any field. In April I attended the 1958 Design Engineering Show and Conference at the Chicago International Amphitheatre. I was particularly interested in the Power and Control section of this conference, attended by many original equipment manufacturers.

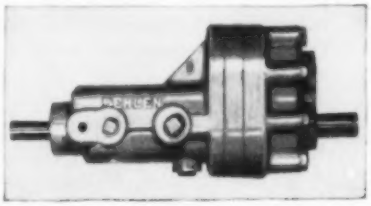
On exhibition here was the Behlen Hydraulic Servo Mechanism, originally known as the Behlen Powr-Steer. This advanced rotary type hydraulic servo mechanism has proved highly successful on thousands of farm tractors. It is a gear-type hydraulic mechanism in contrast to the piston type used on passenger cars and other equipment. The power source is a gear motor that provides continuous 360° turning under full power in either direction.

I found that *this Behlen Hydraulic Servo Mechanism* is capable of almost instantaneous response to the controlling signal. It is actuated by as little as 1 lb. of mechanical force. It also blocks and controls wheel shocks. It does not affect the steering ratio. And by means of mechanical linkage it maintains full and positive control in event of hydraulic power failure.

Behlen was first to offer power steering for row crop tractors, five years ago. For the past two years International Harvester has used it as original equipment on their Farmall 300 and 400 series.

Engineers tell me *the Behlen unit's versatility* suggests it can be easily adapted to many industrial, heavy construction and agricultural equipment applications. And it can be done without drastic and costly engineering changes on production lines.

If you want to see just how easily the mechanism can be applied to your products as original equipment and how it can add a big plus to their sales appeal, get in touch with the Behlen production manager, Howard Christensen. Your request (which will not obligate you in any way) will receive his personal attention.

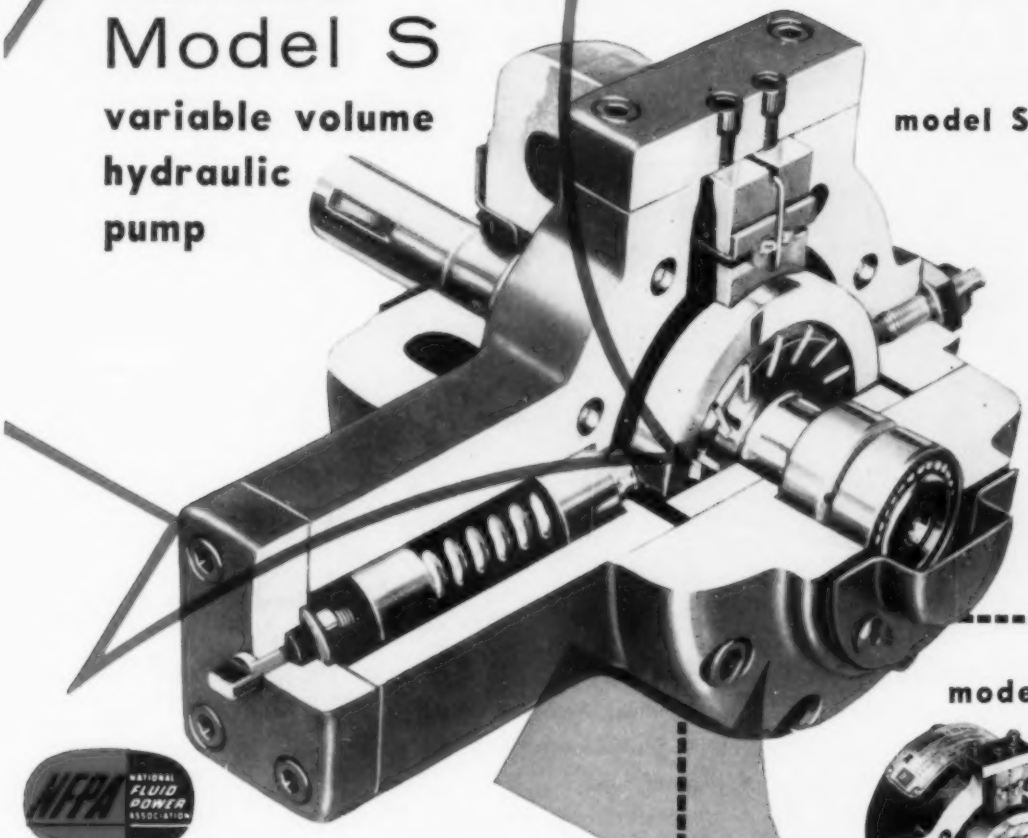


Behlen Manufacturing Company Dept. AH-7, Columbus, Nebraska

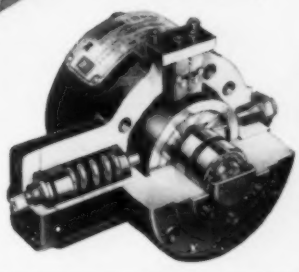
new!

RACINE-SECO Model S

variable volume hydraulic pump



model S



model Q

NFPA NATIONAL FLUID POWER ASSOCIATION

Member

10 gpm-1000 psi-1800 rpm

Here is the "big brother" to the popular Racine Model Q (5 gpm-1000 psi) pump. Both of these pump models answer the needs of builders of quality equipment for accurate control with extremely high circuit efficiency.

Compact design — only 7⅛" long, 6" wide and 4¾" high, makes the Model S ideal for use in areas where space conservation is essential.

When Racine-Seco pumps are used in combination, specifications of 1-1/2 gpm to 70 gpm at pressures up to 10,000 psi are available.

Write for brochure PB-2 which contains complete descriptive literature. Take advantage of Racine's FREE engineering service.

VARIABLE VOLUME *Racine variable volume principle steps up production by extending tool life and increased overall machine efficiency. Saves horsepower.*

CONTROL *A built-in volume control provides adjustment of pump displacement for exact circuit requirements — a feature that reduces motor size.*

GOVERNORS *Both the standard Model S and Model Q utilize the Racine pressure compensating governor. Special governors and governor springs are also available. No relief valves necessary.*

MOUNTING *Standard JIC subplate design for simple installation and maintenance.*

RACINE SECO

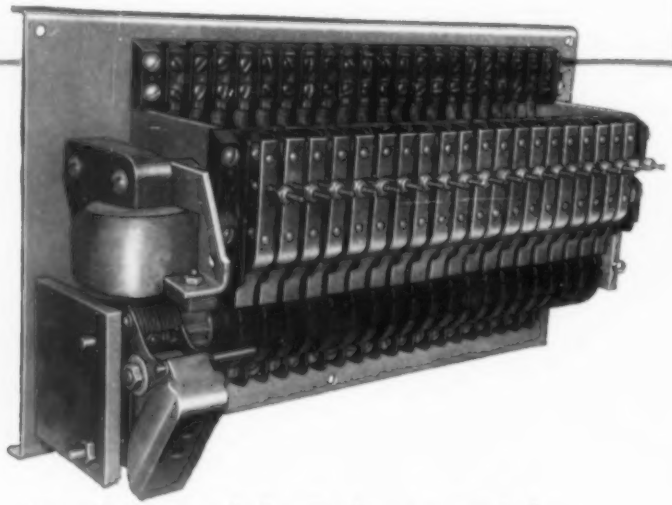
RACINE HYDRAULICS & MACHINERY, INC.

2074 Albert Street RACINE, WISCONSIN

Simplex Engineering Company, Subsidiary, Zanesville, Ohio

CIRCLE 137 ON READER SERVICE CARD

NEW EAGLE STEP SWITCH offers a special approach to automatic process control step sequencing



Development of the Eagle step switch now provides a new approach to process control. Any type of time or sensing device can be used to advance the switch, and a multiplicity of load circuits can be operated in any combination — up to 19 circuits. Devices used to actuate the switch include: push buttons, limit switches, timer intervals, pressure change components, level control apparatus.

The new switch also provides a sequencing interlock when used with multiple indexing circuits. A mechanical circuit interlock by cam action eliminates interlocking relays. Ten ampere switch contacts control load switches direct — no need for load relays. Switch is built with 115 volt coil, and is of heavy duty industrial switch construction throughout.

Make certain you get complete information on this new switch. Send for Bulletin 780. Eagle Signal Corporation, Dept. AH-758, Moline, Illinois.

LETTERS

Equipment", Feb. 1956; "Electric Motors", April 1956; "Timers for Fluid Power Control", July 1956; "Pressure Switches for Fluid Power Control", August 1956; "Push Button Control", Nov. 1956; "Relay and Contractors", March 1957.

A book containing this type of material would prove of great value to hydraulic designers, troubleshooters, teachers, servicemen and salesmen.

JOHN A. MCAFEE
Machine Repair-Foreman
Chevrolet-Cleveland
Cleveland, Ohio

The series of electrical articles by Allan Morris and Ken Rexford are available as photostats only. Price for the complete set is $3.00. *Many of the articles are published in the* FLUID POWER DIRECTORY'S *224 page engineering section.*

Pumps Tolerate Dirt

TO THE EDITOR:

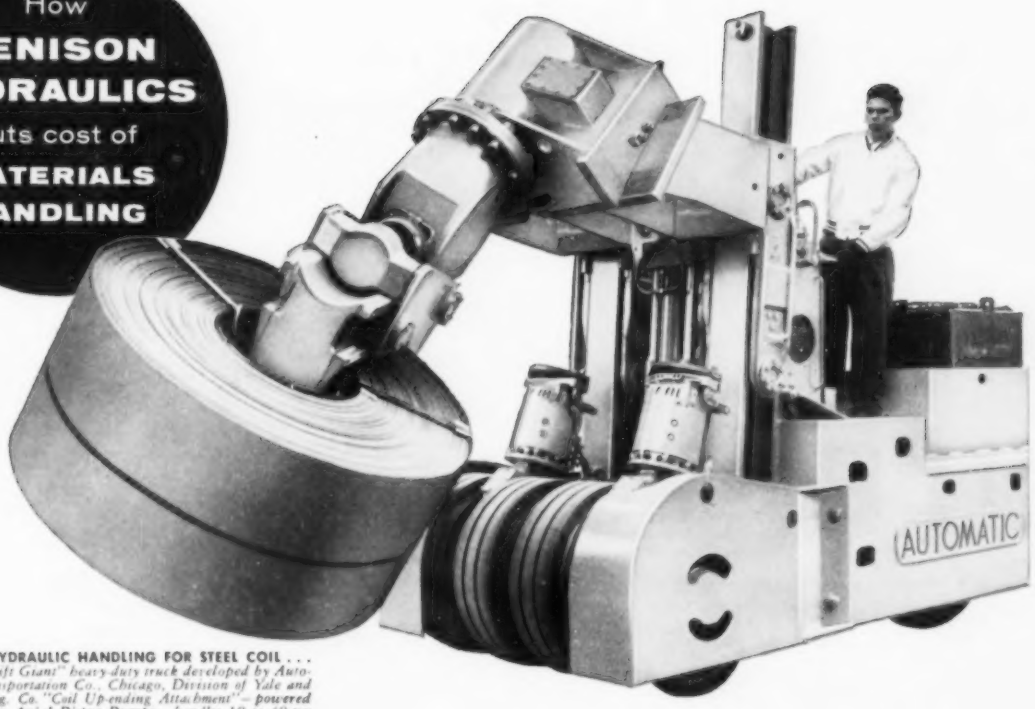
On page 82, April issue, the concluding paragraph in the vane pump section states: "Vane pumps have relatively high efficiencies, Chart 3. Their size is small relative to output. Dirt tolerance is relatively good, but not as good as that of gear pumps."

The writer takes exception to the unqualified statement which does not in any way relate itself to the various design configurations of both vane and gear pumps currently offered for sale. It is true, that particular design approaches of certain vane pumps may make them somewhat less tolerant to dirt than certain other designs of gear pumps. Conversely, many designs of gear pumps render themselves much more subject to early failure with dirty fluid when compared to other designs of vane equipment.

We know of instances where vane pumps have been applied in place of gear pumps because of their greater tolerance to contaminates, and we feel that the sweep-

Continued on page 18

How **DENISON HYDRAULICS** cuts cost of **MATERIALS HANDLING**



SPEEDY HYDRAULIC HANDLING FOR STEEL COIL . . . *on a "Skylift Giant" heavy-duty truck developed by Automatic Transportation Co., Chicago, Division of Yale and Towne Mfg. Co. "Coil Up-ending Attachment" – powered by Denison Axial Piston Pumps – handles 10 to 40-ton loads of steel coil.*

AUTOMATIC® trucks handle steel coil like a baby . . . faster, safer with **DENISON** hydraulic power

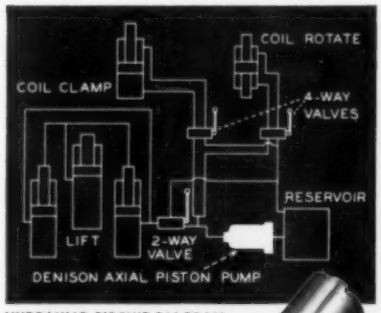
HERE'S the business end of a "Skylift Giant" industrial truck—equipped with a special "Coil Up-ending Attachment". Its jaws easily heft rolls of coiled steel weighing from 10 to 40 tons . . . *with Denison hydraulic power that pays off in smoother, faster, safer handling.*

In leading mills—these heavy-duty trucks speed handling and storage without damaging coils. The Coil Up-ending Attachment is designed to enter the coil's inside diameter with a fixed ram . . . while the outside is gripped by a powerful hydraulic clamp. This clamp-and-ram design prevents "telescoping" of coils during handling.

Three hydraulic cylinders—powered by motor-driven Denison 3000 psi Axial Piston Pumps – furnish lifting and clamping power. All three cylinders are connected hydraulically in parallel which results in a telescopic-cylinder action—but has the added advantage of retaining equal force and speed throughout the stroke at constant pressure and delivery.

Result: operator easily controls lowering speed at any level . . . and can inch the load up from extremely slow speed to maximum for which the flow control is set. *Safe, fast, smooth hydraulic control helps keep "Skylift" trucks continuously on the job . . . handling extra payload.*

Here's the kind of job your Denison Hydraulic Specialist can help *you* do *now*. Call him in soon . . . see how Denison hydraulic power can help put *more payload* into *your equipment*. Write us for details.



HYDRAULIC CIRCUIT DIAGRAM *. . . illustrates system for powering "Coil Up-ending Attachment". Denison equipment delivers hydraulic lifting and clamping power.*

DENISON 3000 PSI AXIAL PISTON PUMP

DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1166 Dublin Road • Columbus 16, Ohio

DENISON STOCKING BRANCH OFFICES

- LOS ANGELES (Hawthorne)
- CHICAGO
- DETROIT (Birmingham)
- ATLANTA
- HOUSTON
- NEWARK (Clark)
- CLEVELAND
- COLUMBUS (Home Office)

Denison and Denison HydrOILics are registered trademarks of Denison Eng. Div., ABSCO

DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

CIRCLE 29 ON TIME-SAVER CARD

NUGENT
FILTERS • STRAINERS
LUBRICATION SPECIALTIES

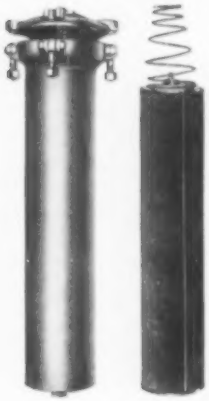


Fig. 1555BF Duplex Filter uses factory packaged laminated fiber disc filtering elements. Each filter comprising duplex operates independently or in parallel. Wide range of sizes.

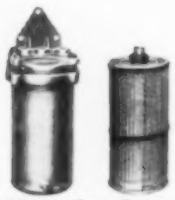


Fig. 1576 Bag-Type Pressure Filters feature inexpensive, completely disposable filter cartridges. For filtering fuel oil, lubricating oil and wide variety of fluids.

AT LEFT: Fig. 1555-4L Filter and laminated disc cartridge. High flow rate; low pressure drop. Excellent micronic efficiency. Cartridges interchangeable with all other Nugent Bag or Depth Type cartridges.

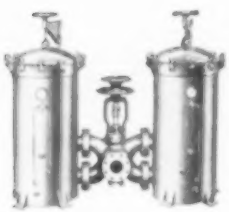


Fig. 1554AN-4L7 Duplex Strainers provide the advantage of uninterrupted flow, without by-passing, while cleaning the strainer baskets. Each strainer comprising duplex uses 7 strainer baskets Fig. 1554A-4L.

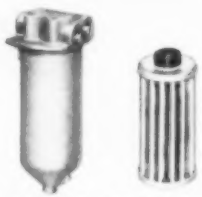


Fig. 1490AM-0 star-shaped extended area strainers offer increased free screen area over round basket type.

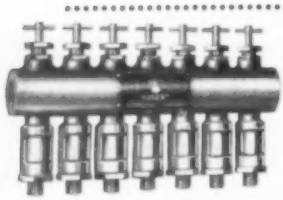


Fig. 1503F Multiple Pressure Oilers are available with from 2 to 24 feeds.

Fig. 524 Sight Feed Valves with removable glass. ¼" to ¾" IPS.

Fig. 1575 Pressure Sight Flow Lubricator. Single units or multiples to 15.

Fig. 1366E Sight Flow Fittings for indicating flow of liquid in a pipe line. Available in brass, cast iron, steel or stainless steel.

Valuable equipment deserves the best possible protection that can be provided. Nugent offers a complete line of filters, strainers and lubrication specialties for this purpose. All are backed by the experience and know-how gained through solving industry's problems in this field for more than 60 years. For bulletins giving complete information on any or all Nugent products, call or write today.

ESTABLISHED 1897

REPRESENTATIVES IN PRINCIPAL CITIES

WM. W. NUGENT & CO., INC.

3432 CLEVELAND STREET, SKOKIE, ILLINOIS

OIL FILTERS • STRAINERS • TELESCOPIC OILERS
OILING AND FILTERING SYSTEMS • OILING DEVICES
SIGHT FEED VALVES • FLOW INDICATORS

LETTERS

ing statement made in this article can not be supported.

ROBERT A. ERSKINE
Chief Engineer
Machinery Products Dept.
Vickers Incorporated

We admit that we fell into the trap of generalities. One piston pump manufacturer also pointed out that our broad statement does not hold true across the board. We hope that Mr. Erskine's letter serves to eliminate any wrong impression the statement about dirt tolerance may have given.

Accumulator Selection

TO THE EDITOR:

I enjoyed reading your April, 1958 issue very much and was especially interested in your articles on hydraulic pump selection and designing with gas-oil accumulators.

Discussing the bladder type accumulator, you say that it is desirable for rapid cycling operations, that the bladder should not be compressed to less than 1/3 the total volume or expanded to more than 2/3 the volume. You then state that a ten gallon accumulator precharged to 1000 psi and operated between 3000 and 1500 psi will deliver 450 cubic inches. Could you forward a formula indicating the method used in determining this usable volume.

R. A. JARASEK
The Oilgear Company
Cincinnati Office

The value of 450 cubic inches was obtained from a nomograph for selecting accumulators. This chart is published in Bulletin A-⅛ issued by Greer Hydraulics Inc. ▼▼▼

FLUID POWER FOR MISSILES AND GROUND SUPPORT EQUIPMENT

. . . will be featured in the September issue of Applied Hydraulics

Houghton 1243 rubber-impregnated leather

The answer to five packing problems

- Positive seal at zero pressure
- Rubber's resilience, without rubber's friction
- Wear far surpassing either homogeneous or fabricated rubber
- Resistance to high pressures and abrasion
- Compatibility with fire-resistant hydraulic fluids and/or mineral oils

applications engineering service

Because Houghton makes both packings and fluids, they maintain a continuing packing-test program offering customer service on packings of all materials, fluids, which it also manufactures, and hydraulic and pneumatic packing applications engineering. As a result, Houghton has become "packing headquarters" for many of the leading manufacturers of hydraulic and pneumatic equipment.

An exclusive Houghton process puts pure polysulphide rubber between the leather fibers of #1243 packings. Penetration is complete.

Porosity often found in leather packings is eliminated. The packing is flexible, easy to install. There is none of the stiffness of wax-impregnation.

Wear resistance is increased by Houghton's process of molding packings with the flesh side of the leather exposed to wear, rather than the smooth, hair side. In tests, #1243 cup packings have run more than twice as long as the total service life of conventional packings, without losing the smallest fraction of their sealing efficiency.

This unique, durable material is available in pre-formed cup packings, "V" packings (which may be used in combination with Houghton rubber and fabricated rubber "V's") and "U" packings.

Write today for the latest #1243 bulletin and engineering information. E. F. Houghton & Co., 303 West Lehigh Ave., Philadelphia 33, Pa.

PACKINGS

. . . products of

E. F. HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

Victor Regulators control high pressure gases...safely and accurately

GD700 SERIES for testing pneumatic components or operating gas systems. Gas-O-Dome primary regulator is controlled by a relief venting, high pressure, spring loaded regulator. This combination offers you precise regulation for both low or high volume applications.

MODEL	PSI MAX. INLET	PSI OUTLET RANGE	GAUGES (integral or panel mounting)
GD710	7000	400-7000	10,000-10,000
GD711	7000	200-3600	10,000- 5,000
GD712	7000	200-2000	10,000- 4,000
GD713	7000	50- 800	10,000- 1,000
GD714	7000	10- 150	10,000- 200
GD700	3600	200-3600	5,000- 5,000
GD701	3600	200-2000	5,000- 4,000
GD702	3600	50- 800	5,000- 1,000
GD703	3600	10- 150	5,000- 200

Flow: Approx. 300 scfm. Leakage: None.
Operating temp. range: −67° F to +200° F (Storage −80° F)

LR SERIES Loading Regulators for "dead end" and low capacity testing (2 sfcm.) of pneumatic components, or for operating gas systems. Will hold dead-end pressures without leakage—also will hold supply pressure even when inlet pressure decreases.

MODEL	PSI MAX. INLET	PSI OUTLET RANGE
LR20B	7000	40-7000
LR19B	7000	20-3600
LR18B	7000	15-2000
LR17B	7000	10- 800
LR16B	7000	5- 200

Operating Temp. Range: −67° F to +200° F (Storage −80° F)
Leakage: None.

BOTH GD700 AND LR SERIES are field proved. They regulate all non-corrosive gases, including oxygen. Forged bronze bodies; stainless steel trim; Kel-F seats; internal filters; built-in adjustable relief. Proof pressure 2 times rated pressure; burst pressure 3 times rated pressure. Panel mounting. Stainless steel models available for corrosive gases. For complete specifications, write us today.

VICTOR for welding

VICTOR EQUIPMENT COMPANY

Mfrs. of welding & cutting equipment; high pressure and large volume gas regulators; hardfacing rods, blasting nozzles; cobalt & tungsten castings; straightline and shape cutting machines.

47

844 Folsom St., San Francisco 7 • 3821 Santa Fe Avenue, Los Angeles 58 • 1145 E. 76th St., Chicago 19
J. C. Menzies & Co., Wholly-Owned Subsidiary

T-J spacemaker cylinder

Quality Engineered

to give quality results

with Extras . . . at No Extra Cost!

You get more—much more—when you specify and use any of T-J's complete line of Spacemaker cylinders. The Spacemaker is engineered to give you better, more accurate, and longer service—offers, exclusively, many extras . . . that are STANDARD, AT NO EXTRA COST!

Designed to eliminate tie-rods, providing greater strength . . . saves space . . . reduces manhours and costs in all push-pull-lift operations. IMMEDIATE SHIPMENT in a wide range of styles and capacities, with 64,000 combinations. Write for Bulletin SM 155-3 with complete engineering details. The Tomkins-Johnson Co., Jackson, Mich.

T-J TOMKINS-JOHNSON
RIVITORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

METAL PISTON ROD SCRAPER . . . Standard at No Extra Cost!

NEW "SUPER" CUSHION FOR AIR . . . Standard at No Extra Cost!

CHROME PLATED CYLINDER BORES AND PISTON RODS . . . Standard at No Extra Cost!

ONE PIECE PISTON . . . Standard at No Extra Cost!

NEW "SELF-ALIGNING" MASTER CUSHION FOR HYDRAULIC USE . . . Standard at No Extra Cost!

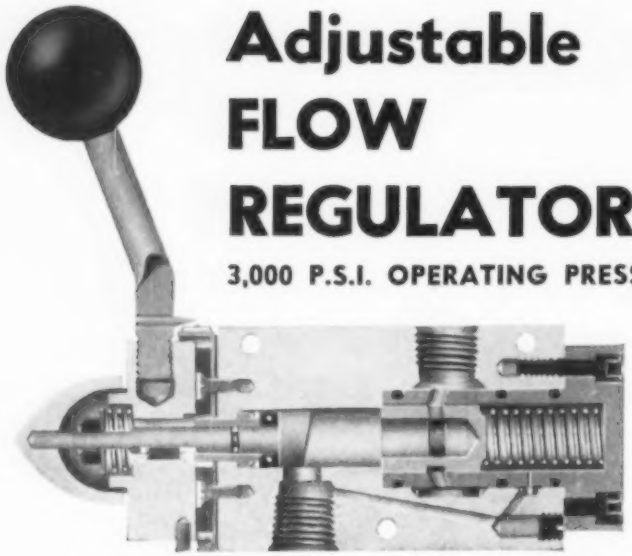
NO TIE-RODS TO STRETCH . . . Standard at No Extra Cost!

STREAMLINED DESIGN . . . Oil Pressure to 750 P.S.I.—air to 200 P.S.I. Standard at No Extra Cost!

FORGED SOLID STEEL HEADS . . . Standard at No Extra Cost!

Adjustable FLOW REGULATOR

3,000 P.S.I. OPERATING PRESSURE



MODEL 1407 Series

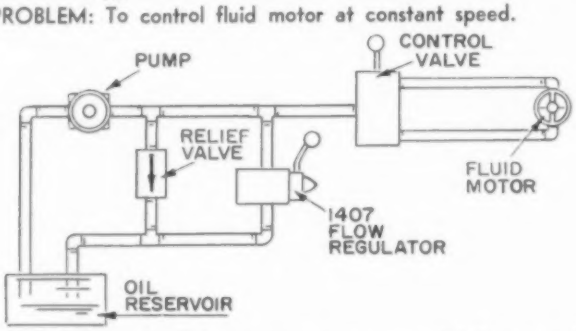
New applications for economical methods of controlling fluid motors and cylinders has prompted our company to design a full range adjustable flow regulator.

Ordering Data

MODEL NO.	MINIMUM FLOW IN G. P. M.	MAXIMUM FLOW IN G. P. M.
1407 R-4-12	0.5	12
1407 L-4-12	0.5	12
1407 R-4-20	0.5	20
1407 L-4-20	0.5	20

R Right Hand—Clockwise rotation from closed to open facing control handle.
L Left Hand —Counter clockwise rotation from closed to open facing control handle.

PROBLEM: To control fluid motor at constant speed.



Model 1407 regulator is a pressure compensated full range adjustable regulator that will maintain constant flow regardless of pressure or load changes. Circuit above allows operation at a pressure equal to load pressure on motor. Speed of motor is controlled by regulating by-pass to reservoir.

WRITE FOR SHEET 1.04

Other Waterman products:

- **Solenoid Valves**
- **Check Valves**
- **Unloading Valves and Filters**

WATERMAN
ENGINEERING COMPANY
725 CUSTER AVENUE **EVANSTON, ILLINOIS**

FUTURE EVENTS

September 15-19: Instrument Society of America, 13th annual instrument automation conference and exhibit, Convention Hall, Philadelphia, Pa.

September 22-24: Standards Engineers Society, 7th annual meeting. Benjamin Franklin Hotel, Philadelphia, Pa.

September 29-October 3: ASTE Semi-Annual Meeting and Western Tool Show. Shrine Exposition Hall, Los Angeles, Calif.

October 13-15: ASME-ASLE Lubrication Conference, Statler Hotel, Los Angeles, Calif. Papers will be presented on lubrication, wear, and high temperature. For further information contact R. B. Purdy, 150 East 42nd St., New York City.

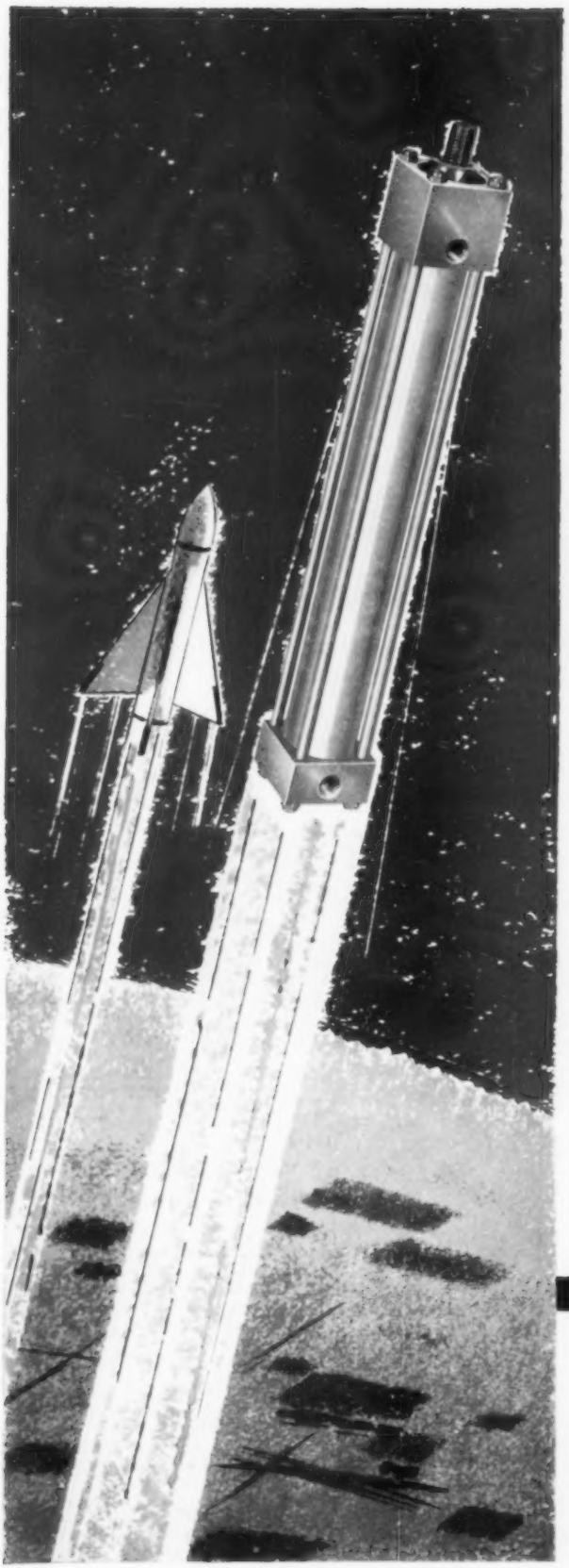
October 14-16: Society of Industrial Packaging and Material Handling Engineers. National Exposition, The Coliseum, Chicago, Ill.

October 16-17: NCIH 14th Annual Meeting. Sherman Hotel, Chicago, Ill. For complete information write Raymond D. Meade, Conference Secretary, Illinois Institute of Technology, Chicago, Ill.

October 27-31: American Society for Metals, National Metal Exposition and Congress. Public Auditorium, Cleveland, Ohio.

November 3-5: National Fluid Power Association fall meeting, Drake Hotel, Chicago, Ill. For information write Barret Rogers, Executive Secretary, 1618 Orrington, Evanston, Ill.

December 4-5: Industrial Engineering Conference, Illinois Institute of Technology, Chicago, Ill. ▼▼▼



ORTMAN-MILLER Launches Another Star Performer... The O-M Automation

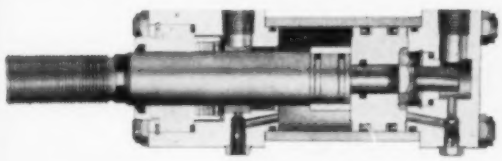
Heavy-Duty Air and Hydraulic Cylinders

1000 PSI Hydraulic — Series RH

200 PSI Air — Series RA

available in 1½" to 8" bores

Meets JIC and Automotive Industry "Automation Standards"



Any resemblance between a guided missile and an O-M AUTOMATION cylinder is purely coincidental. However, each stands as a symbol of progress in its own field.

In the Series RA and RH air and hydraulic cylinders O-M has incorporated many advanced features in an extremely rugged line of cylinders designed to meet automotive industry specifications for Automation cylinders. The advanced design of these cylinders makes them well suited for severe applications in all types of machinery and equipment.

For detailed information, consult your local O-M representative or see our new catalogues No. 107 for Air Cylinders— No. 108 for Hydraulic Cylinders.

Mail coupon below for your copy!

ORTMAN-MILLER MACHINE COMPANY

1 143rd Street, Hammond, Indiana

☐ Have representative call

☐ Send Bulletins 107 and 108

Name_____ Position_____

Company_____

Address_____

City_____ Zone____ State_____

CIRCLE 89 ON TIME-SAVER CARD

ACCO
Helicoid
Gage
U.S.A.

NOTHING BUT THE BEST IN GAGES FOR WORKING PRESSURES FROM 30" VACUUM TO 10,000 p. s. i.

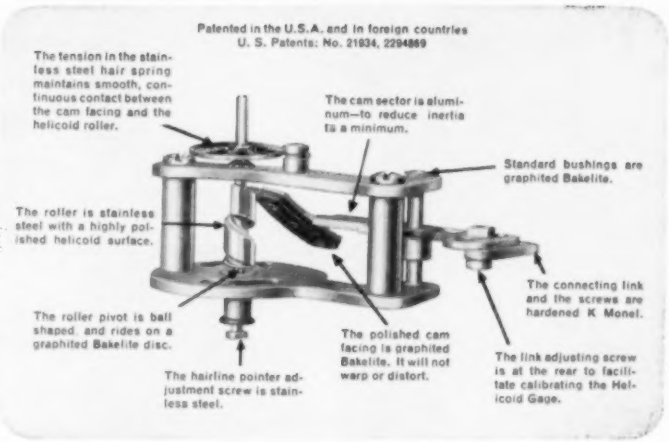
Shock-Proof Cam Actuation (no gears—no teeth) Makes Helicoid Gages Ideal for Hydraulic Services

Designed for pulsating and impact hydraulic service, the Helicoid movement releases at zero in the event of sudden pressure reduction. This eliminates shock on pointer and movement by reducing impact of pointer against pointer stop pin. This protects the gage mechanism where gages may be subject to occasional vacuum.

The superiority of Helicoid Gages is most evident in severe service—wherever a gage is subjected to violent pressure pulsations or certain severe mechanical vibrations.

The *sustained accuracy* of Helicoid Gages over *millions of cycles* is explained by the details of design and construction of the Helicoid movement shown at the right.

Rolling action of the cam facing against the roller surface . . . graphited Bakelite bushings, roller pivot base and cam facing . . . K Monel connecting links and screws . . . all such Helicoid features protect against wear and corrosion and assure sensitivity, sustained accuracy and trouble-free operation through millions of cycles.


Patented in the U.S.A. and in foreign countries
U. S. Patents: No. 21934, 2294869
The tension in the stainless steel hair spring maintains smooth, continuous contact between the cam facing and the helicoid roller.
The cam sector is aluminum—to reduce inertia to a minimum.
Standard bushings are graphited Bakelite.
The roller is stainless steel with a highly polished helicoid surface.
The connecting link and the screws are hardened K Monel.
The roller pivot is ball shaped, and rides on a graphited Bakelite disc.
The polished cam facing is graphited Bakelite. It will not warp or distort.
The link adjusting screw is at the rear to facilitate calibrating the Helicoid Gage.
The hairline pointer adjustment screw is stainless steel.

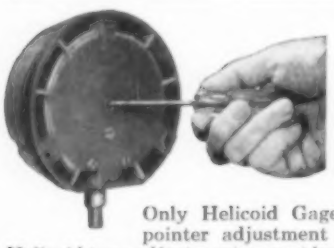
HELICOID GAGE CARTRIDGE SNUBBER

(Patent pending)

Enlarged cutaway view

This is a simple, effective throttling device to reduce or eliminate pulsations of the gage pointer. There are no moving parts, no adjustments needed. Available in three types in powdered bronze or stainless steel for air, gas, water, steam, medium or heavy liquids.

Threaded cartridge body for assembly in any Helicoid Gage tapped socket shank



EASIEST ADJUSTMENT AND CALIBRATION

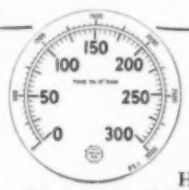
Only Helicoid Gages have the external pointer adjustment pictured here. The Helicoid type adjustment cannot be jarred out of position.

Calibration of Helicoid Gages is accomplished easily, without removing dial or pointer, because the link adjusting screw is at the rear of the system.

TUBES BUILT FOR MILLIONS OF PRESSURE PULSATIONS

To fit the wide range of applications, Helicoid Bourdon tubes are available in four materials—alloy steel, K Monel, stainless steel and phosphor bronze.

All Helicoid tubes are made from seamless tubing and are carefully designed to give maximum torque and minimum stress. When used within the dial range, they will withstand many millions of pressure pulsations and will not stretch, leak nor crack.



DOUBLE SCALE DIAL SHOWS TONS ON RAM AND PSI

Helicoid Gage dials are supplied in jet black with white figure markings or in dull white with black figure markings. They are constructed of laminated phenol with a transparent plastic surface and the longest possible scale length for more accurate readings. They are non-corroding, will not discolor nor fade and will not crack, chip nor peel.

ACCO

Helicoid Gage Division
AMERICAN CHAIN & CABLE

929-H Connecticut Avenue • Bridgeport 2, Connecticut

TRADE MARK

Helicoid gives you all these features at prices that are competitive in the quality gage field

Webster

NEW HIGH CAPACITY FLOW DIVIDER

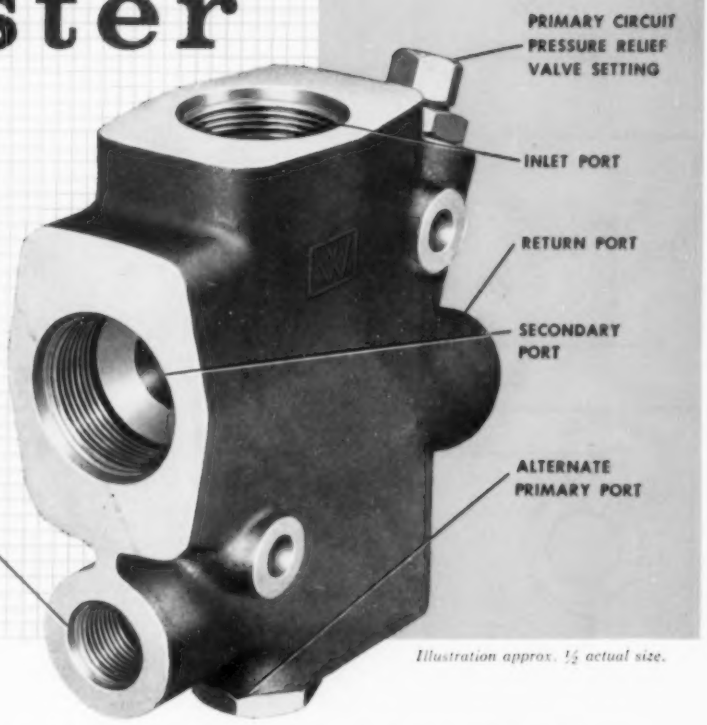


Illustration approx. ½ actual size.

It could have been designed to your exact specifications

Webster's high capacity (60 gpm) flow divider is that versatile. Here's standard design that gives you a free hand in planning your hydraulic circuits — and adapts so easily and economically to your product and the job. With its small size (approx. 6½" x 5⅜" x 2½"), it fits easily in remote locations, tight quarters.

The new flow divider — operating up to 2000 psi — completely eliminates the need for a second pump. It supplies two hydraulic circuits, such as power lift and power steering, and permits each to be operated *simultaneously* at different pressures from *one single pump!* It also has a built-in relief valve on the constant flow section.

Could you use this new Webster flow divider on your product? Benefits like these add up to big dollars, better performance. Write for additional information.

call the man from Webster

OIL HYDRAULICS DIVISION

WEBSTER ELECTRIC

RACINE · WIS

See us at Booth 586 Design Engineering Show

- ☐ Have THE MAN FROM WEBSTER contact us.

Please send the following:

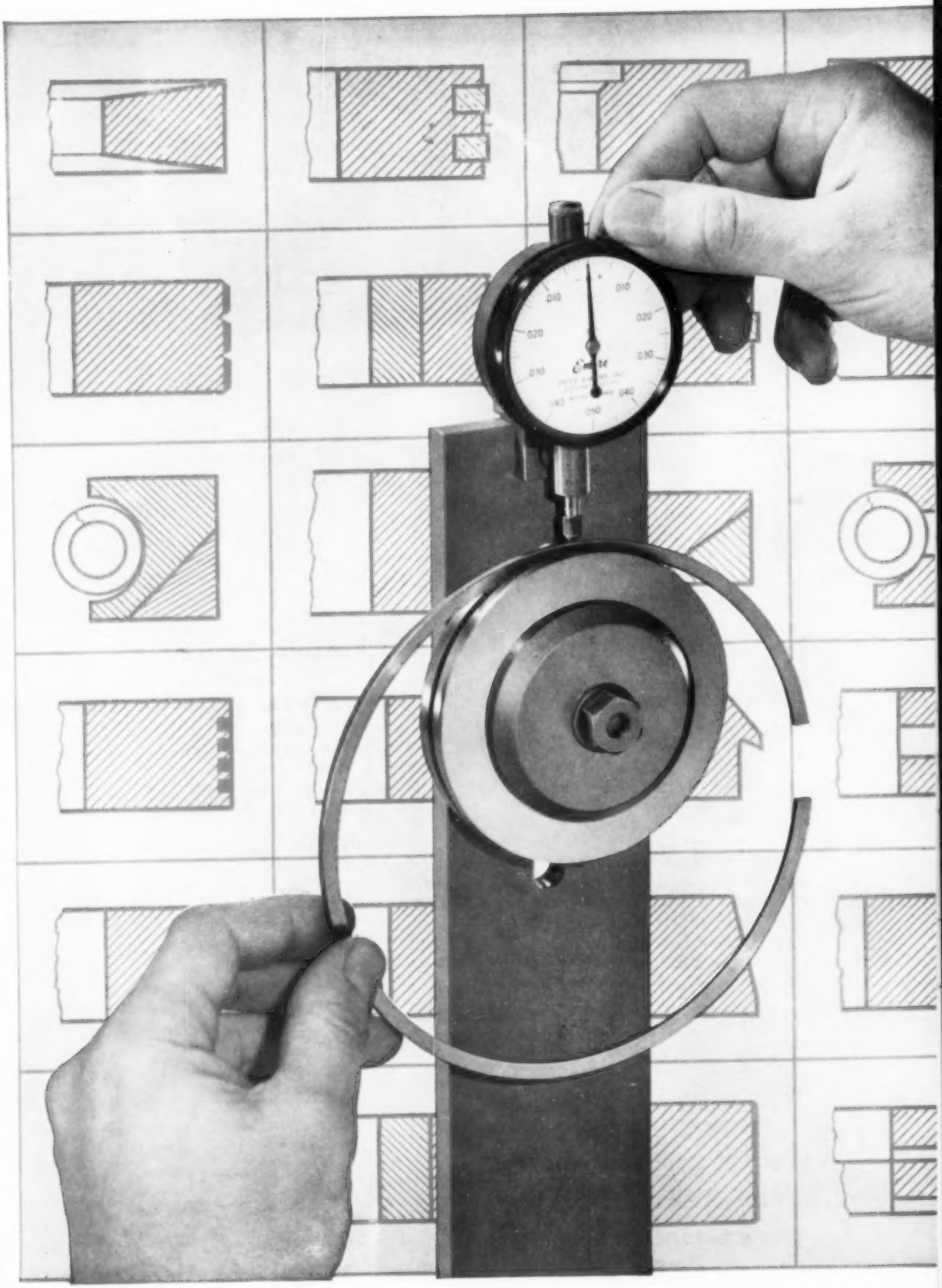
- ☐ Complete Hydraulic Catalog (H3A3) of pumps, valves, and fluid motors.
- ☐ New information or data as published.

Name .....

Title .....

Company .....

City ..... State .....



Let's Face It

Koppers holds that a piston ring is no better than its wearing face

Koppers ability to design piston rings with the precise configuration that meets engine requirements can save you operational and maintenance dollars.

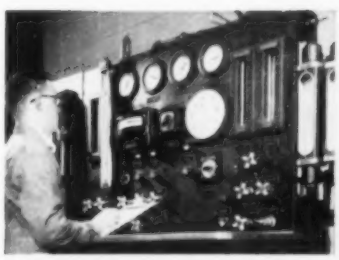
You can select from hundreds of ring configurations that provide optimum sealing with predictable performance in most industrial applications while ideally meeting all requirements of oil control and wear resistance. Or, Koppers, with its 36 years of experience, can design a ring to match your specific requirements.

Koppers Piston Rings have proved themselves wherever piston rings are used and particularly where operating conditions are critical... in internal combustion engines, steam engines, pumps, compressors and valves. Look to Koppers for the solution to your piston ring problems. Write for complete information today to: KOPPERS COMPANY, INC., 1507 Hamburg Street, Baltimore 3, Md.

KOPPERS

PISTON AND SEALING RINGS

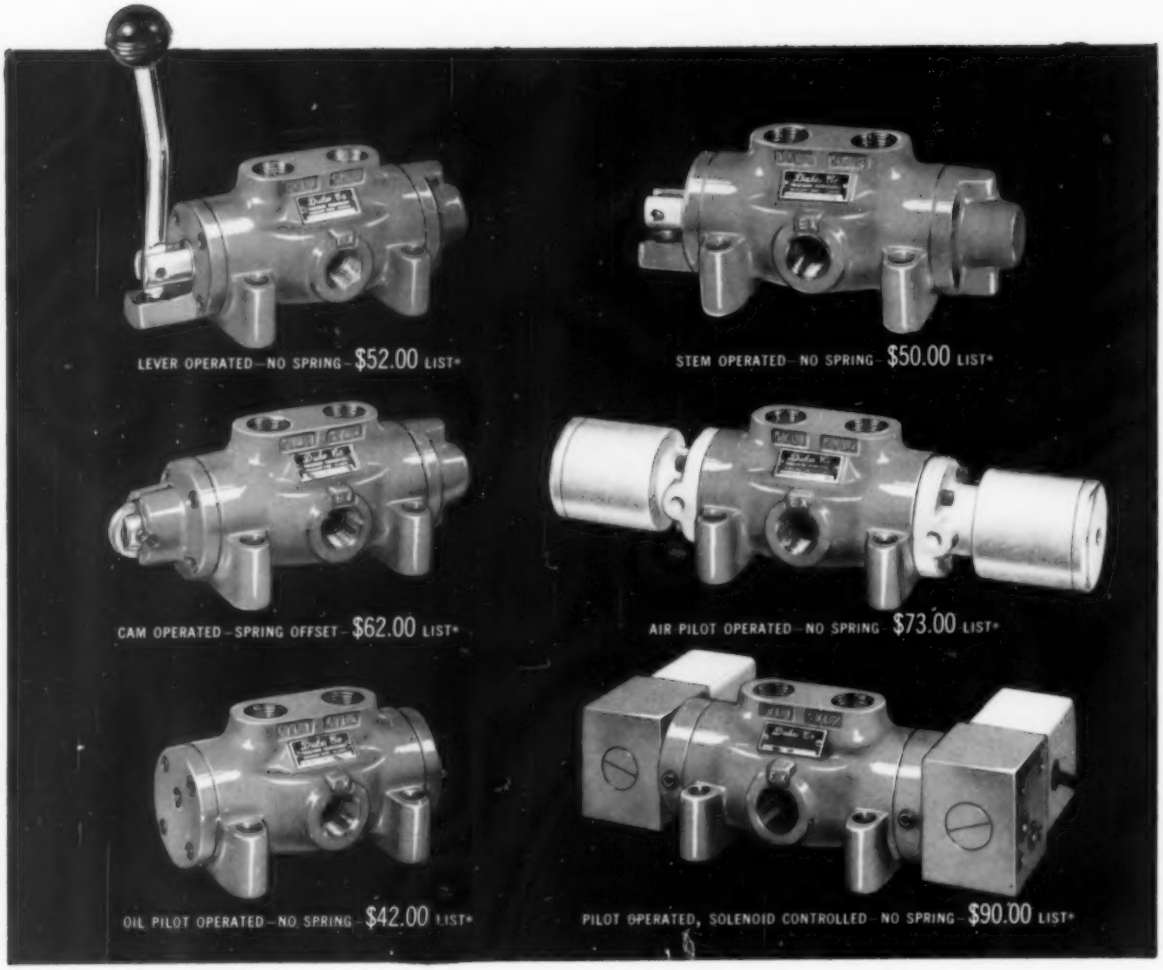
Engineered Products Sold with *Service*



Fluid Dynamics Knowledge gained by Koppers through many years of experience helps solve the most complicated problems involving the control of gases under pressure.

Face Design Knowledge gives Koppers the ability to produce rings and seals that give reliable and economical. performance under the most demanding operating conditions.

Materials Knowledge enables Koppers to select the proper material or combination of metals, plastics or ceramics to insure maximum efficiency and length of service.


LEVER OPERATED—NO SPRING—$52.00 LIST*
STEM OPERATED—NO SPRING—$50.00 LIST*
CAM OPERATED—SPRING OFFSET—$62.00 LIST*
AIR PILOT OPERATED—NO SPRING—$73.00 LIST*
OIL PILOT OPERATED—NO SPRING—$42.00 LIST*
PILOT OPERATED, SOLENOID CONTROLLED—NO SPRING—$90.00 LIST*

CHECK the prices! COMPARE the specs!

You'll find this NEW line of valves costs less and operates to higher requirements

. . . and TANDEM SPOOLS are available at no extra cost

- Available for pressures up to 3000 PSI
- Choice of 4 spool actions: spring centering, spring offset, no spring in detent or friction pad type
- Choice of 3 standard spools and 5 alternates
- National Acme solenoids
- Full area internal porting
- ½" and ¾" pipe sizes

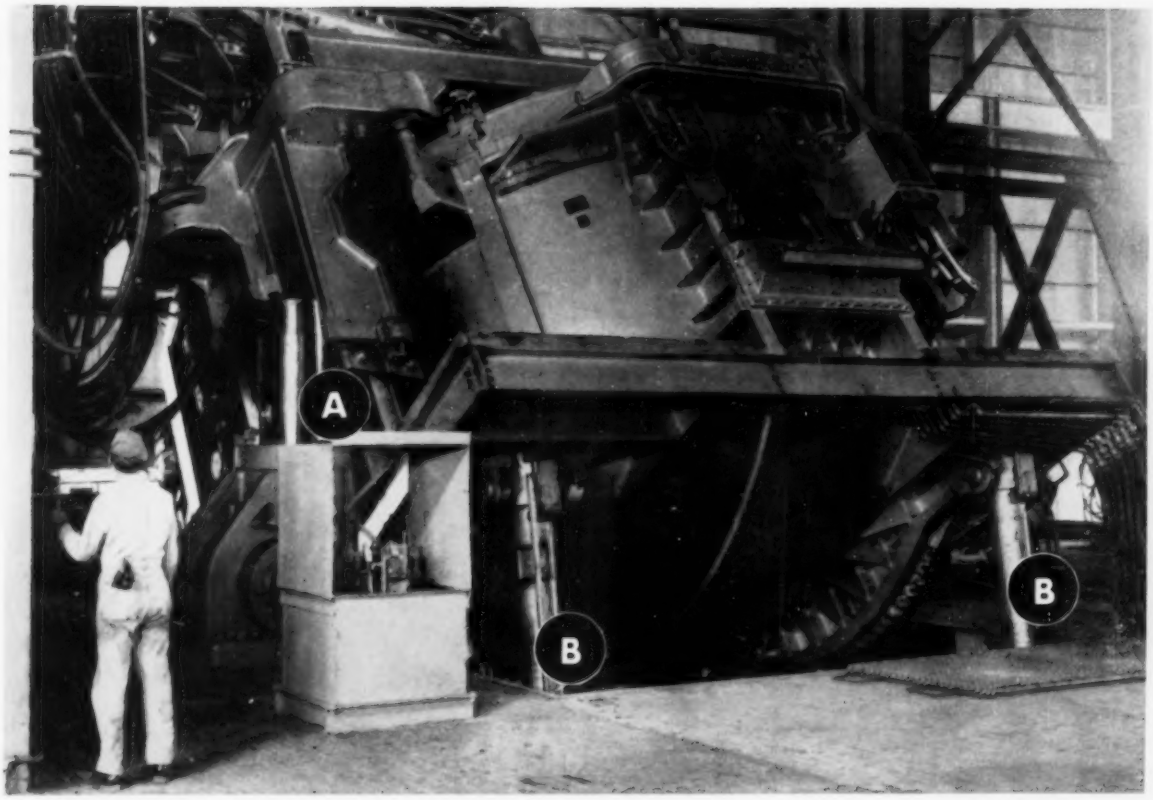
**prices applicable in the U.S.*

Send for complete new Dukes Catalog

DUKES

HYDRAULIC OIL VALVES

Dukes Company Inc. • 3999 North 25th Avenue • Schiller Park, Ill. • A Chicago Suburb



A. Vertical hydraulic ram lifts the entire roof of the furnace and swings it to one side with ease . . . use of efficient hydraulic power and dependable Pydraul F-9 helps electric furnaces cut charging time to half that of open-hearth furnaces.

B. Two hydraulic cylinders tilt the Lectromelt furnace to pour "heats" as large as 200 tons . . . give safe, unfailing power and sensitive control with fire-resistant Pydraul F-9 in the system. *Furnace built by Lectromelt Furnace Div., McGraw-Edison Co., Pittsburgh, Pa.*

Hydraulic power helps Lectromelt furnace cut charging time in half—pours 3,000° F. steel *safely* with fire-resistant PYDRAUL

Powerful Lectromelt furnaces melt tons of steel at temperatures well over 3,000° F. Extra-hot process makes flammable hydraulic fluid a potential fire hazard in lines and cylinders—calls for firesafe Pydraul F-9. In tests and actual service, Pydraul F-9 has been discharged over molten metal, red-hot ingots, electric arcs, and open flame without igniting.

Pydraul F-9 lubricates like a premium-grade petroleum oil—works well at all extremes of pressure found in industrial hydraulic systems. Good anti-wear qualities and non-corrosive features give equipment longer life. And moneysaving stability lets you reclaim Pydraul simply by cleaning . . . you can use it over and over again.

Take a tip from leading equipment manufacturers . . . eliminate flammable hydraulic fluid wherever it so much as hints at being a fire hazard. A small investment in Pydraul now can repay you many times over in protection *and* performance. Your Monsanto representative will be glad to demonstrate the firesafety of Pydraul versus your present fluid, to calculate the low cost of conversion and to help you make the change.

MONSANTO CHEMICAL COMPANY
Organic Chemicals Division, Dept. OEM-14
St. Louis 24, Missouri

Write for free Pydraul F-9 Fact Book and a Monsanto Hydraulic Fluid Hazard Survey Sheet.

Lectromelt: McGraw-Edison T.M., Reg. U.S. Pat. Off. Pydraul: Monsanto T.M., Reg. U.S. Pat. Off.

Pydraul F-9—first and only hydraulic fluid listed by Underwriters' Laboratories.

"In respect to fire hazard, Pydraul F-9 is rated by Underwriters' Laboratories, Inc., 2 to 3 in a class much less flammable than paraffin(petroleum)oil, according to a schedule in which Ether is rated 100; Gasoline, 90-100; Alcohol (ethyl) 60-70; Kerosene, 30-40; Paraffin oil, 10-20."

Monsanto

WHERE CREATIVE CHEMISTRY WORKS WONDERS FOR YOU

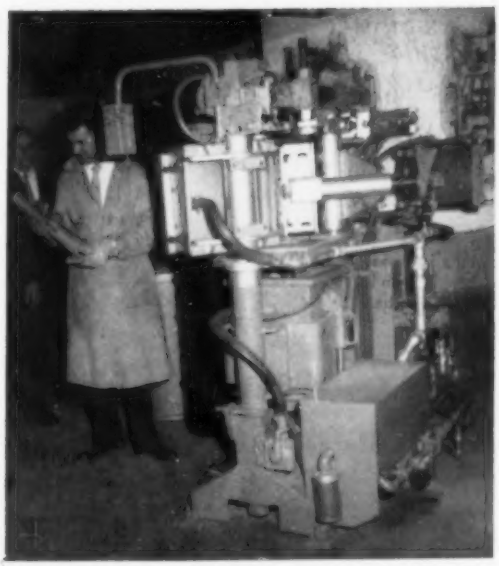
BRIEFS

about fluid power

FLUID POWER ON FOUNDRY EQUIPMENT

An APPLIED HYDRAULICS Photo Report

Compressed air has long been a workhorse in foundries. Take this photo tour with AH's editors through the 62nd Foundry Show held in Cleveland the week of May 19th. Our ace "cylinder seekers" were like kids in a candy shop. Here are many design application ideas and evidence of greater use of hydraulics on foundry equipment.



CLOSE COUPLED needle-type flow controls regulate speed on a 12 inch bore air cylinder which opens and closes this shell molding machine. Cylinder piston drives a clever swing out mechanism which makes it easy to unload the finished core. Osborn Mfg. Co., Cleveland, O.

IT'S A GASSER and the vertical air cylinder lowers the sand cores placed in a cage into the treatment chamber. The chamber is evacuated and pressurized through two cycles and the air cylinder raises the cured cores. Alphaco, Inc., York, Pa.

TWO STATION ROTARY action powered by a hydraulic torque actuator speeds production on this shell molding machine. Cam operated deceleration valves give smooth positioning. C & S Products Company. Detroit, Mich.

C/R now offers you the advantages of reinforced TFE... designed, compounded and molded by a single source!

If your work involves sealing applications, you are probably familiar with "Teflon", Tetrafluoroethylene Resin. The extreme versatility of its chemical, thermal and mechanical properties are unmatched by any other material on the market.

You may not be, however, fully aware of the degree to which these properties can be distinctly improved by the use of reinforcing inorganic additives. For example, "Teflon" can be blended with inorganics to increase:

- **Resistance to deformation under load — by a factor of 10**
- **Resistance to wear by rotating shafts — by as much as 500 times**
- **Stiffness — by a factor of 4-5**
- **Thermal conductivity—by a factor of 5-10**
- **Compressive strength — by a factor of 3-4**
- **Hardness — by 10%**

It is also useful to know that Chicago Rawhide is one of the few fabricators which blends its own "Teflon" compounds, assuring constant quality in batch after batch and permitting compound formulations to be developed rapidly and accurately. Our new laboratory and production facilities are unexcelled – and these facilities are matched by our experience in molding synthetic parts to meet the most critical specifications.

C/R Sirvene welcomes the opportunity to cooperate with you in the design and production of "Teflon" and reinforced "Teflon" packings, bearings, gaskets, rings, or other parts.

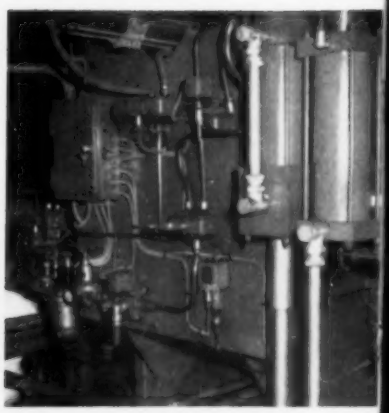
If you are interested in "Teflon" write for your free copy of Sirvene Materials Bulletin CT-1.

*"Teflon" is a DuPont registered trademark

CHICAGO RAWHIDE MANUFACTURING COMPANY
1203 ELSTON AVENUE • CHICAGO 22, ILLINOIS
Offices in 55 principal cities. See your telephone book.
In Canada: Manufactured and Distributed by Chicago Rawhide Mfg. Co. of Canada, Ltd., Brantford, Ontario. **Export Sales:** Geon International Corp., Great Neck, New York.
Other C/R Products: *C/R Shaft and End Face Seals • Sirvis-Conpor mechanical leather cups, packings, boots • C/R Non-metallic Gears*

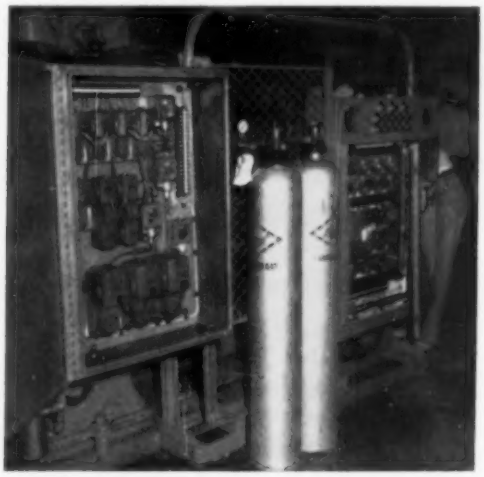
SIRVENE C/R DIVISION
CHICAGO RAWHIDE

BRIEFS

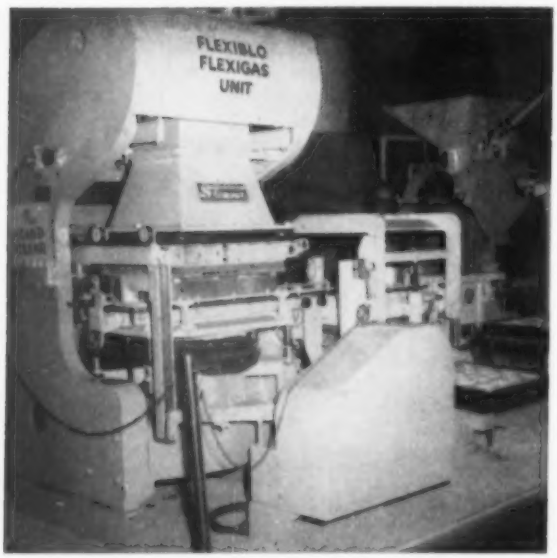


COMBINATION AIR-OIL CYLINDERS are an important part of equipment where smooth motion is required for rollover and stripping operations. Boosters give necessary squeeze pressure. Panel showing air valves, pressure switch, booster and combination cylinder is on a core blower. F. E. (North American) Ltd., Toronto, Canada

LARGE VALVES, electrically controlled, direct 80 psi air to give pulsating or continuous blow on this core making machine. Filling and closing is air powered and controlled. Archer-Daniels-Midland Company, Cleveland, O.

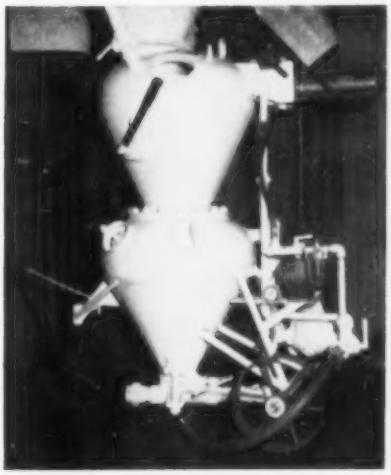


END OF CHRISTMAS TREE CIRCUITS? Designers using pneumatics are catching up with some good design ideas that have been used on hydraulic equipment. This panel has manifold mounted air valves. The design sells itself. Used on a core maker, the cabinet mounted valves stay clean and readily accessible for service. International Molding Machine Company, LaGrange Park, Ill.



PILOT AND CAM operation control the entire sequence of this new core maker. There's a 15 to 20 sec adjustable cycle. No electrical controls are used. Air powered rotary torque actuators with hydraulic dashpots give transfer and rollover motions. Beardsley & Piper, Chicago, Ill.

POWER ASSIST on this sand rammer is hydraulic. Gripping the handle energizes a directional valve controlling a slave cylinder. Putting all controls in machine head eliminates trailing hose and swivels. F. E. (North American) Ltd., Toronto, Canada



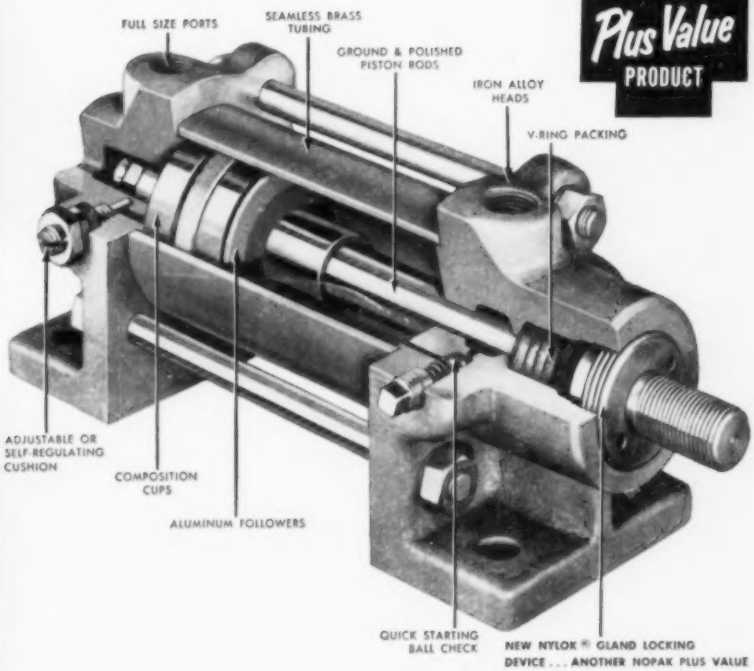
MODERN POT-BELLY STOVE? No, it doesn't throw heat; it blows lining and patching material into cupolas. The air cylinder operates a gate which controls material feed into the lower pressurized section where a 2.5 hp, 1500 rpm air motor drives an agitator. Blastcrete Equipment Company, Los Angeles, Calif.

BIGGER FLASKS handled automatically mean more hydraulics in the foundry. This 70 gpm, 30 hp pump unit powers a giant (15,000 lb load) jolt, rollover, draw machine. A single valve actuates entire oil powered cycle—clamp, rollover, vibrate, slow draw and final draw. Beardsley & Piper, Chicago, Ill.

Plus Value Performance

is built into NOPAK Air Cylinders

A NOPAK *Plus Value* PRODUCT


FULL SIZE PORTS
SEAMLESS BRASS TUBING
GROUND & POLISHED PISTON RODS
IRON ALLOY HEADS
V-RING PACKING
ADJUSTABLE OR SELF-REGULATING CUSHION
COMPOSITION CUPS
ALUMINUM FOLLOWERS
QUICK STARTING BALL CHECK
NEW NYLOK ® GLAND LOCKING DEVICE . . . ANOTHER NOPAK PLUS VALUE

Class 1 and 2 Air Cylinders

Pressures to 250 P.S.I.

Features? Check These—

- **CHOICE OF CUSHIONING ACTION:** All Class 1 and 2 cylinders are available with non-cushioned, self-regulating or adjustable cushioned heads on either or both ends.
- **QUICK STARTING:** Quick opening ball-check valve assures starting under full power.
- **LIGHTWEIGHT COMPONENTS:** Piston follower and follower-ring made of aluminum, wherever suitable, reduce piston weight up to 60%, result in faster starting, more power, longer cup-packing life in horizontally mounted cylinders, reduced impact.
- **PISTON PACKING TYPES:** Standard piston assemblies utilize dependable composition self-sealing cups, for air, oil or water service. Other types available include:
  - Leather cups for medium and low pressure
  - Impregnated fabric cups for high pressure oil or water
  - Graphite impregnated cups for high temperatures
  - Piston-ring type for special applications
- **SELF-LOCKING PACKING GLAND:** New gland design utilizes Nylok ® for positive locking.
- **SELF-COMPENSATING V-RING PACKING:** Requires no adjustment; assures longest possible trouble-free operation.
- **BRASS TUBING:** Hard drawn, seamless, straight and concentric; impervious to corrosion.
- **CYLINDER HEADS:** Iron Alloy for durability and long life.

Shelf-Stock Service on Standard Models

NOPAK Class 1 Self-Regulating Cushion Air Cylinders are available from stock in a range of bore sizes and stroke lengths from 1½" x 1" to 8" x 15" in 6 Standard Models. Ask your NOPAK representative for the latest NOPAK Shelf Stock listings, or they will be sent with your request for Catalog 101-A covering the complete line of NOPAK Air Cylinders.

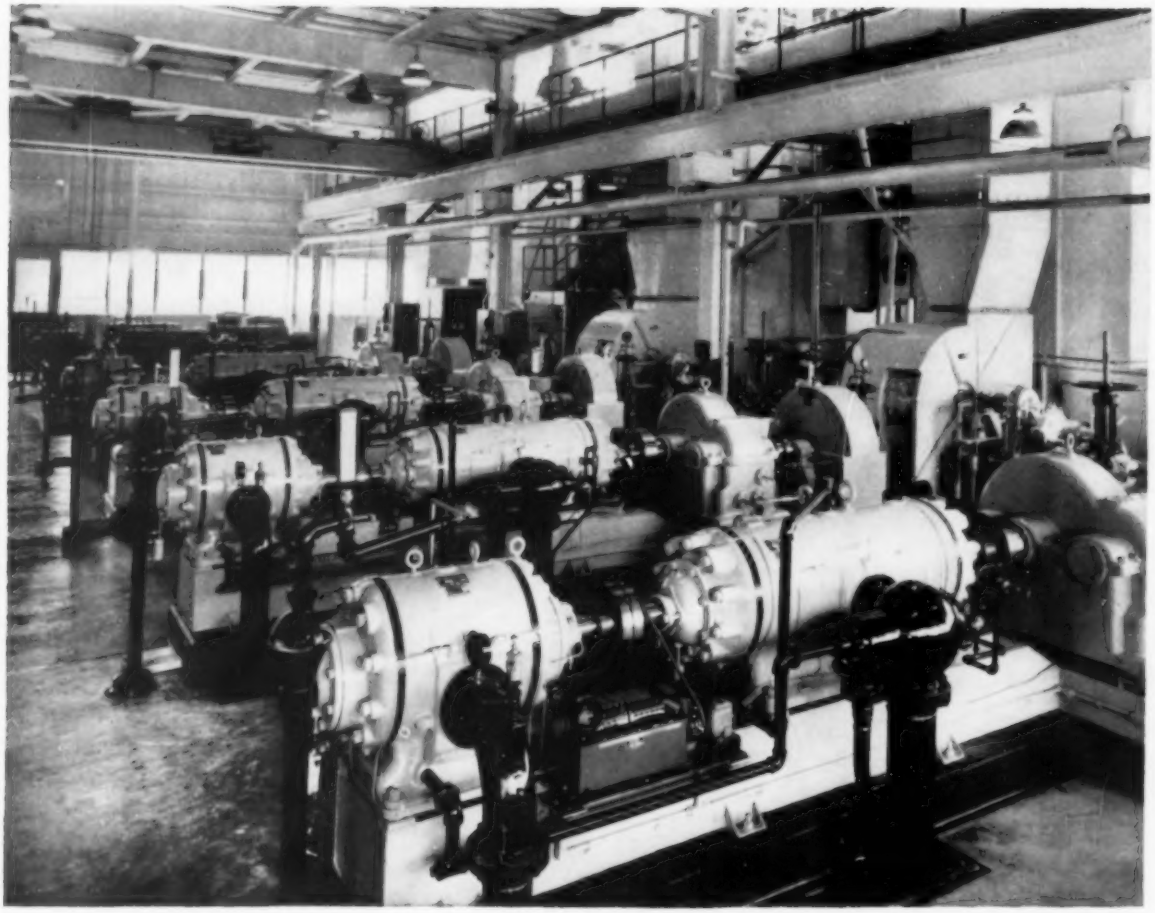
® Registered Trade Mark, The Nylok Corp.

Representatives in Principal Cities

NOPAK *VALVES and CYLINDERS*

Galland-Henning NOPAK Division • 2743 S. 31st Street • Milwaukee 46, Wis.

CIRCLE 45 ON TIME-SAVER CARD



4 YEARS - - 25,000 HOURS OPERATING PERFORMANCE!

This is just one of many production records set by Fuller Rotary Compressors—in this case by each of six machines installed in a leading aircraft plant. The only maintenance or replacement necessary over this period was installation of high and low pressure blades. Bearings held up 100%.

Fuller rotary compressors shown are four C-300-300H, steam turbine drive, capacity each 1248 to 1805 c.f.m., with speed ranges of 450 to 650 r.p.m., 125-lb. gauge pressure, and two electric motor drive, capacity each 1663 c.f.m., at 600 r.p.m., 110 lb. gauge pressure.

Your plant, too, can take advantage of the many cost-saving advantages of Fuller rotary compressors; such as smooth airflow, lack of vibration minimum of moving parts, adaptability to any production setup, and the advantage of "one man" operation.

Write today to Fuller Company and get complete data on how Fuller rotary compressors can give you more air power at less cost.

Fuller

FULLER COMPANY GENERAL AMERICAN TRADE MARK

FULLER COMPANY C-312 4659

142 Bridge St., Catasauqua, Pa.

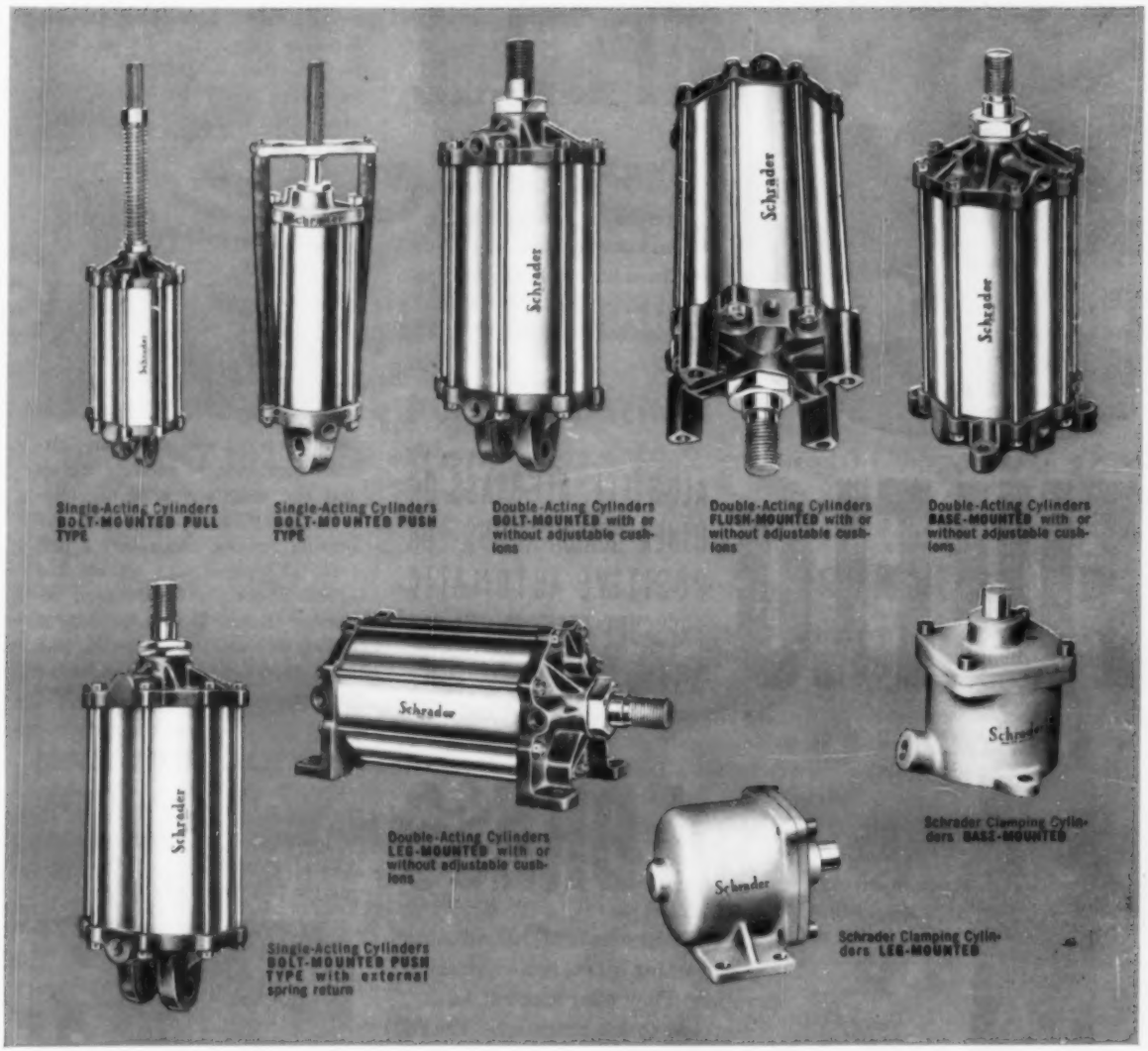
SUBSIDIARY OF GENERAL AMERICAN TRANSPORTATION CORPORATION

Birmingham · Chicago · Kansas City · Los Angeles · San Francisco · Seattle

See Chemical Engineering Catalog for details and specifications

PIONEERS OF HIGH-EFFICIENCY VANE TYPE ROTARY COMPRESSORS SINCE 1930

SELECT FROM 9 TYPES AND THOUSANDS OF SIZES...
SCHRADER AIR CYLINDERS
GIVE YOU THE WIDEST SELECTION


Single-Acting Cylinders BOLT-MOUNTED PULL TYPE
Single-Acting Cylinders BOLT-MOUNTED PUSH TYPE
Double-Acting Cylinders BOLT-MOUNTED with or without adjustable cushions
Double-Acting Cylinders FLUSH-MOUNTED with or without adjustable cushions
Double-Acting Cylinders BASE-MOUNTED with or without adjustable cushions
Double-Acting Cylinders LEG-MOUNTED with or without adjustable cushions
Schrader Clamping Cylinders BASE-MOUNTED
Schrader Clamping Cylinders LEG-MOUNTED
Single-Acting Cylinders BOLT-MOUNTED PUSH TYPE with external spring return

PLUS HUNDREDS OF VALVES, ACCESSORIES AND EVERYTHING YOU NEED FOR AIR CONTROL

Schrader® a division of SCOVILL

Use the full Schrader line to do your air control selecting. Your Schrader distributor can help you pinpoint what you need. For 84-page catalog write:

A. SCHRADER'S SON • *Division of Scovill Manufacturing Company, Incorporated*
456 Vanderbilt Avenue, Brooklyn 38, N. Y.

QUALITY AIR PRODUCTS

CIRCLE 102 ON TIME-SAVER CARD

all STEEL

New Fulflo all-steel, piston type, oil relief hydraulic by-pass valves combine proven features with the advantages of all-steel construction in flange models from 1" to 3".

FULFLO

ALL-STEEL, ALL-BRASS OR OTHER COMBINATIONS FOR POSITIVE AUTOMATIC PRESSURE CONTROL YOU CAN DEPEND UPON AT ALL TIMES

all BRASS

Fulflo Valves feature shear-closing action for quiet, non-chattering operation. They offer greatest safety, matched to job conditions. Priced right for O.E.M. use . . . built right for superior replacement service.

- Standard and flanged models
- Just 6 springs for pressures to 500#
- Steel, cast iron or brass bodies
- Brass, steel or stainless pistons
- Pipe sizes to 3"
- **Specials** to your requirements

COMPLETE CATALOG FREE ON REQUEST

THE FULFLO SPECIALTIES CO., INC.
415 Fancy Avenue, Blanchester, Ohio

FULFLO

BRIEFS

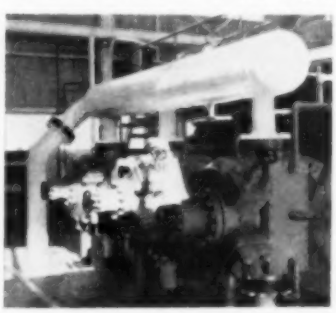
Holler—It Will Start Or Stop

At the recently held first Southwestern Metal Show, Womack Machine Supply Co., Dallas, Texas, exhibited a new type electro-pneumatic circuit panel. This type of circuit simulation panel had

both electrical and pneumatic circuits combined to actually set up and run most any kind of cylinders, valves, air motors, pressure sensing devices, and rotary actuators. The panel was set up and operated with a complicated sequence circuit. It also included a device to control the start and stop of the panel by modulated voice control. ▼▼▼

Snubbers Prevent Pulsation Trouble

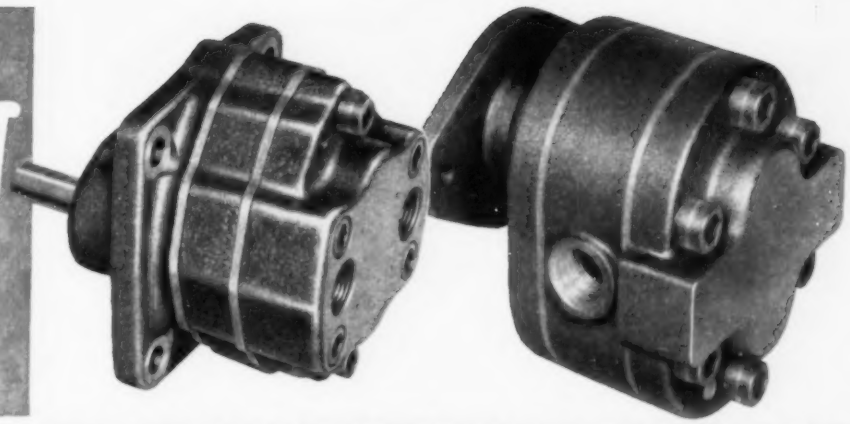
Installation of snubbers at the Downingtown, Pa., compressor station of the Manufacturers Light



and Heat Company prevented a serious pulsation condition. Both inlet and discharge snubbers were installed on the two three-compressor cylinder 1100 horsepower

Continued on page 38

NEW



TUTHILL POWERMAX

Hydraulic pumps and Fluid motors

- **For pressures to 1500 psi**
- **Pump capacities from 1.2 to 14.2 gpm**
- **For speeds to 3600 rpm**

TUTHILL, producers of quality pumps since 1927, proudly announces its new line of POWERMAX hydraulic pumps and fluid motors. Produced in a complete selection of seven different models, these rugged, compact new units incorporate the quality construction and advanced engineering that industry has learned to expect from TUTHILL.

POWERMAX pumps and fluid motors use precision-ground, involute spur gears of heat-treated alloy steel, especially designed for efficient and quiet operation. Large, heavy-duty, anti-friction bearings . . . hard, long-wearing, double wear plates of a special bronze alloy . . . double lip-type shaft seals . . . generously proportioned heat-treated alloy steel shaft . . . these are just a few of the many quality construction features which insure long, trouble-free life for POWERMAX pumps and motors.

The compact design of these units saves space and simplifies installation problems. They can be provided for either flange or foot mounting and with either side or rear ports as standard (front porting is available on special order). POWERMAX pumps or motors may be supplied with a built-in relief valve if desired.

Duplex or tandem models

For applications such as power steering where two pumps of substantially different operating characteristics are required, POWERMAX pumps may be furnished in duplex or tandem models, with both units mounted on a single shaft. This allows substantial savings through the elimination of a second driving source, reductions in hydraulic piping, and lower installation costs.

A new Catalog, No. 111, gives complete information on these new POWERMAX pumps and hydraulic motors. Included are performance curves, dimensional data, construction features . . . all the detailed engineering information you need. Write today for your copy.

TUTHILL PUMP COMPANY
981 East 95th Street, Chicago 19, Illinois

☐ Please forward copy of Catalog No. 111 on new POWERMAX hydraulic pumps and fluid motors.
☐ Please have your representative call.

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____

Tuthill Manufactures a Complete Line of Positive Displacement Rotary Pumps in Capacities From 1 to 200 GPM; for Pressures to 1500 PSI; speeds to 3600 RPM.

TUTHILL PUMP COMPANY
981 East 95th Street, Chicago 19, Illinois

PUMPS FOR YOUR PURPOSE

CIRCLE 117 ON TIME-SAVER CARD

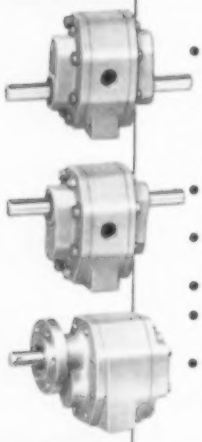
Precision-machined trouble-free hydraulic

PUMPS, MOTORS and VALVES

. . . by the World's Largest Builder of Hydraulic Jacks

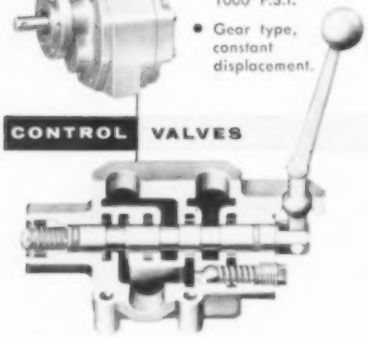
• Back of all Hein-Werner hydraulic controls are 30 years of engineering knowledge and precision craftsmanship.

PUMPS AND MOTORS



- Forced lubrication and internal bleeding for axial balance and to eliminate high pressures against oil seals.
- Rotate in either direction.
- Heavy-duty roller bearings.
- Small cube space.
- 8, 17, 25 GPM at 1000 P.S.I.
- Gear type, constant displacement.

CONTROL VALVES



- Large oil passages.
- Close grained, high tensile alloy body castings.
- 2 types of action.
- Spring centered, ball detent hold.
- Hardened ground spool.
- Precision honed valve body.
- Pressure relief valve
- Hardened seat insert for long life.

Hein-Werner Corporation Waukesha Wisconsin

wide selection of models in stock . . . Hydraulic assemblies engineered to your specifications.

Manufactured by

HEIN-WERNER CORPORATION
WAUKESHA, WISCONSIN

BRIEFS

compressor units. A pulsation survey using an oscilloscope showed that at an engine speed of 335 rpm and 235 psig line pressure, a peak pressure change ranging from 12.15 psi to 7.33 psi in the suction nozzles between the compressor cylinders and the inlet snubbers was prevented from entering the piping system by the inlet snubber as evidenced by a peak pressure change of only 3.06 psi upstream of the inlet snubber. It was also shown in the survey that at an engine speed of 335 rpm and 1005 psig line pressure, a peak pressure change ranging from 40.3 psi to 89.0 psi in the discharge nozzles between the compressor cylinders and the discharge snubber was reduced by the snubber to a peak pressure change of 4.72 psi downstream of the discharge snubber. ▼▼▼

Continued on page 40

BRIEF NOTES

ANOTHER TEFLON PRODUCT SOURCE . . . Johns-Manville has completed the installation of machines to make Teflon products which include hydraulic packings and seals.

PRODUCTION AND DEVELOPMENT PERSONNEL . . . can request on their company letterhead the new 54-page brochure "Action at UAP" published by United Aircraft Products, Inc., Dayton, Ohio. It reviews the company's facilities for the production of components and systems.

WALTER FERRIS . . . a pioneer in hydraulic and co-founder of The Oilgear Company died April 16, 1958, at the age of 90 years. Ferris assigned more than 140 patents to Oilgear since 1917. Among his "firsts" was the hydraulic broaching machine, radial, rolling piston pump design, and hydraulic feed controller.

PREVENT RUST ON TUBING . . . Research carried on at Superior Tube Company shows that carbon and low alloy steel tubing can be best protected against rust with a reinforced micro-crystalline wax base preventative having inhibitors. Cleaning before use is easy. This rust preventative is non-staining, easy to handle and economical.

VALVE WITH INTEGRAL LIMIT SWITCH . . . At a recent Engineering Society meeting Vickers' Robert Erskine told of the development of a solenoid valve with an integral limit switch. It will give simple, reliable, safety interlocking.

BUSINESS BRIEFS

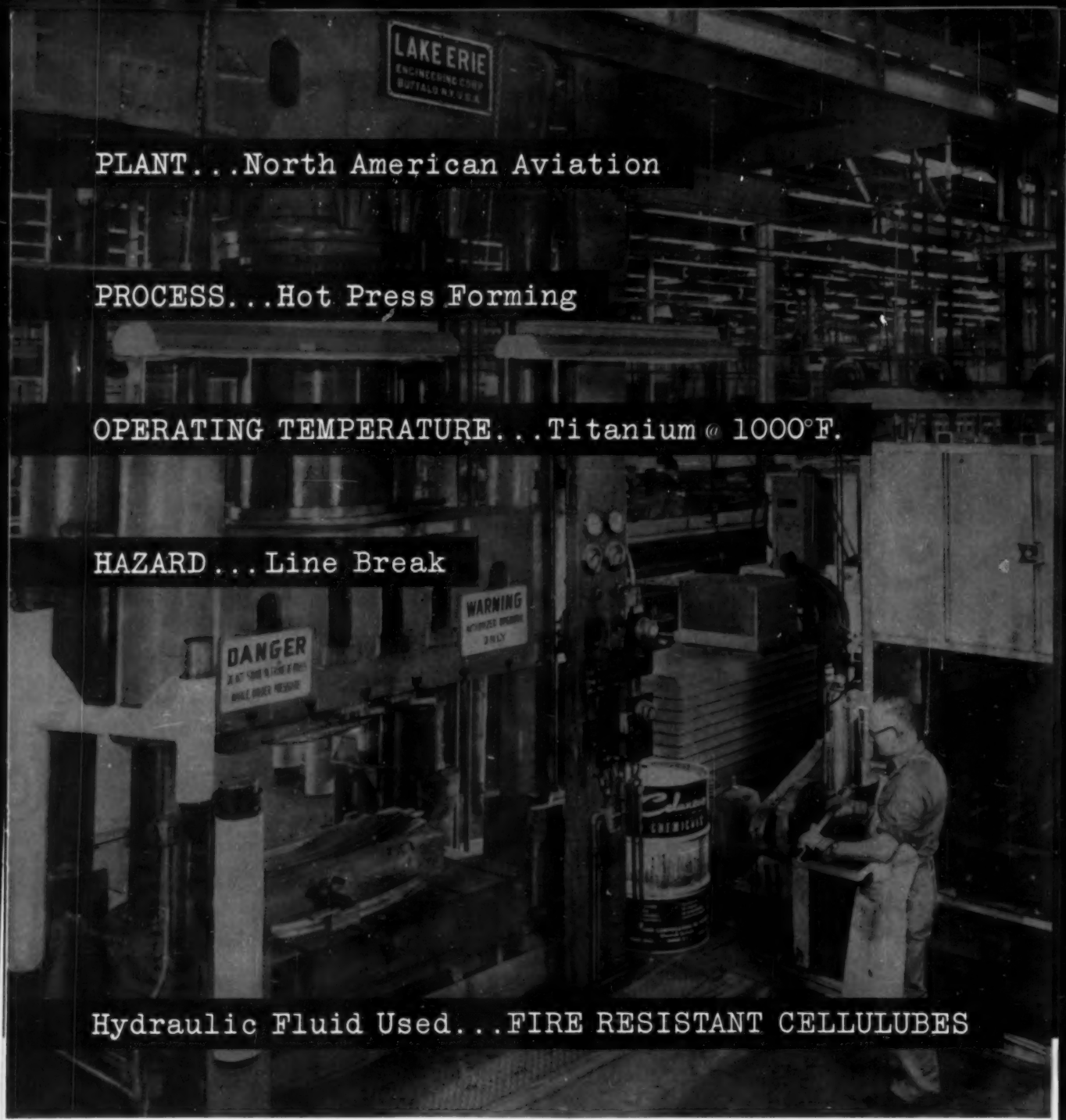
NEW HYDRAULIC SOURCE . . . Texas Hydraulics Inc., Austin, Texas, has been formed to produce pumps based on Elek F. Benedek patents. Basic pump design is a radial piston, high pressure—both constant and variable displacement. Eric Wahlquist heads the new company. W. B. Strickland is engineering v-p. Complete line of vane and gear pumps are in development.

BROWN & SHARPE MFG. CO. ACQUIRES GEROTOR-MAY CO. . . . With acquisition of the Gerotor-May Co. of Baltimore, Brown & Sharpe's recently formed hydraulics division will further enlarge its hydraulic product line. It is planned that the Gerotor line of pumps and fluid motors will be manufactured at the Manchester, Michigan, plant.

IMPROVEMENTS IN EARNINGS . . . is looked for in the second half of fiscal year at Aeroquip Corp. The second fiscal quarter net was up 64% over the December quarter. Aeroquip order intake during the month of March exceeded shipments by more than 1 million dollars.

CIRCLE 55 ON TIME-SAVER CARD

CIRCLE 138 →



To assure maximum safety in the operation of a specially developed hydraulic press for form-die quenching, North American Aviation uses Cellulube 220 fire-resistant synthetic fluid.

During the process, fully expanded parts, @ 1000° F, are transferred from a nearby electric furnace to the press for hot-forming aircraft parts made with high-strength alloys.

Cellulube . . . the *safe* hydraulic fluid . . . is available in six controlled viscosities. One of them is best suited to your purposes and to the safety of your plant and personnel. So, for safety's sake, investigate Cellulubes. We will be glad to supply the information you want. If you'd like to have a sample, please let us know the application involved.

Celanese® Cellulube®

Cellulube . . . a Celanese fire-resistant functional fluid

CHEMICALS

Celanese Corporation of America, Chemical Division, Dept. 588-G, 180 Madison Avenue, New York 16, N. Y.

Export Sales: Amcel Co., Inc., and Pan Amcel Co., Inc., 30 Madison Avenue, New York 16, N. Y.

Specify
PAGE Dependable
Leather Packings
. . . Available for Temperatures to 225° F.

You get these Important Advantages

- for temperatures −65° F. to 225° F.
- have low coefficient of friction
- do not readily cold flow
- suitable for a wide range of pressures (from ounces to thousands of pounds psi)
- will not score or abrade
- permit greater metal clearances
- adaptable to a wide range of operating conditions
- can be stored indefinitely

Specify Page Packings. You'll get the full cooperation of an organization with complete facilities and nearly a century of experience and know-how. Write for your copy of the Page Packing Manual.

PAGE BELTING CO. trademark

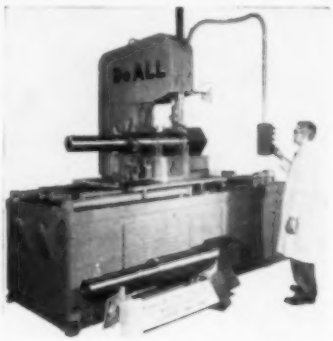
PAGE BELTING COMPANY
established 1868

Concord — New Hampshire
Page Packings — engineered to do a better job

BRIEFS

Heads-Up Heads-Down With Fluid Power

This hydraulic system doesn't exactly toss coins—but it does almost achieve tossing you around in bed. Detroit Harvester Company, Detroit, Mich., now manufactures a hydraulic power unit for hospital and other beds, eliminating manual hand cranking.



A HYDRAULIC MOTOR drives the lead screw to provide variable speed and rapid traverse on this band mill. The speed is controlled by regulating the flow of oil to the hydraulic motor. This is done by a panel of pushbuttons and selector switches. Made by DoALL Co., Des Plaines, Ill.

A mere touch of a four button thermoplastic hand switch makes it possible for a patient or nurse to maneuver the bed into one of many positions. Head and foot movement is controlled separately. A special solenoid valve in each hydraulic cylinder securely locks the spring in any desired position. ▼▼▼

Air Cylinders Control Gear Tooth Honing Machine

Two methods of gear honing can be done on this machine, Model GHC. The zero-backlash method is used for very close tolerances. With this method, an air cylinder tilts the work into a

Continued on page 42

CIRCLE 90 ON TIME-SAVER CARD

CIRCLE 31

Decco PRESENTS

MINIATURIZED INDUSTRIAL SOLENOIDS *with multi-million cycle performance!*

THESE ARE INDUSTRIAL QUALITY SOLENOIDS!

Decco 01 series produces 1¾ lbs. force at ½" stroke. Quiet hold at 4¾ lbs. force. Decco 02 series produces 2¾ lbs. force at ½" stroke. Quiet hold at 5½ lbs. force. Both series are available in push or pull models, vertical or horizontal mounting.

Decco's series 01 and 02, miniature, AC solenoids have all the fine qualities of their well known, standard size, companion models. Quality and performance are the same—only the size has been changed . . . and thorough "in service" testing has proved them worthy of the Decco name.

These miniature solenoids are built with high quality, silicon steel structure to prevent "aging". Coils are heavy duty Nylclad wire, glass taped and sealed for long life. Shading coils are silver soldered for durability and quiet hold and Decco's new "quick change" patented feature affords fast, simple, thirty second coil change, when necessary.

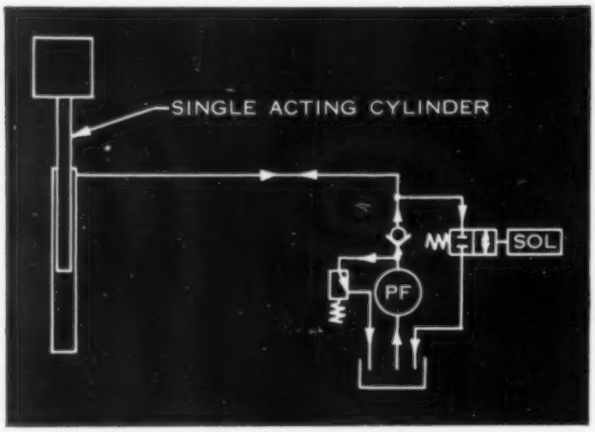
If you have an application for a quality-built, miniature solenoid that will stand up under heavy industrial use, it will be worth your while to investigate Decco's 01 and 02 series miniatures.

Decco SOLENOIDS THE HEART OF DEPENDABLE AUTOMATION EQUIPMENT

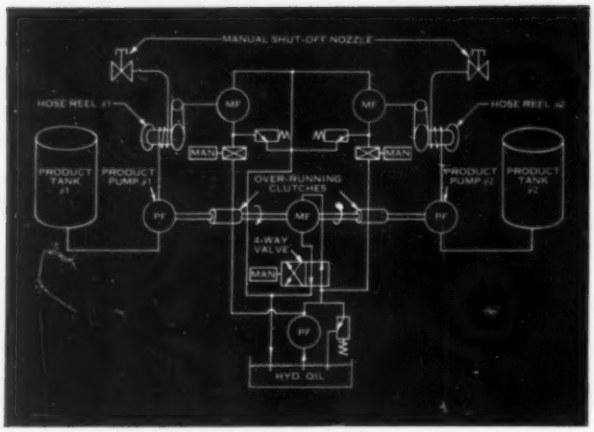
DETROIT COIL COMPANY

2435 HILTON ROAD, FERNDALE 20, MICHIGAN

SIMPLE CIRCUIT



COMPLEX CIRCUIT



ROPER
Serves Both Best

The key to any hydraulic system is the pump. It must have the proper characteristics in relation to the other equipment in the circuit — whether simple or complex. It must also be *dependable* and have the *stamina* to provide long and trouble-free service. Roper Rotary Pumps *have* the attributes that are so necessary to effect optimum performance, and you can count on them for successful control of circuits involving either tons or pounds. On your next hydraulic problem, investigate Roper Rotary Pumps. Find out how they can be the key to a dependable hydraulic system.

PUMPS TO 1000 P.S.I.
•
HYDRAULIC PUMP-MOTORS
High Torque Low Speed
Up to 11.5 H.P. output

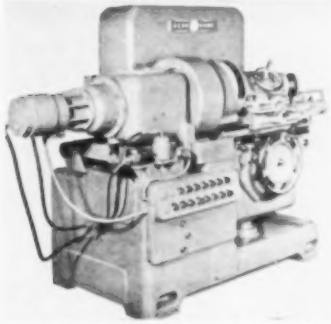
SEND FOR CATALOG

ROPER HYDRAULICS, INC.
707 Blackhawk Park Avenue
Rockford, Illinois

ROPER
ROTARY PUMPS

BRIEFS

tight-mesh loading with the hone. Another air cylinder locks the gear in this fixed center-distance position for the honing cycle. At the end of the cycle the air cylinder lock is released and the main



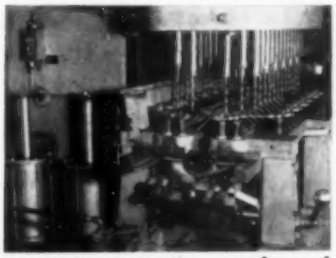
air cylinder tilts the work up for unloading.

In the constant-pressure method the work is tilteed into controlled tight-mesh contact with the honing tool by the air cylinder. The cylinder maintains a constant pressure between the work and tool during honing.

Another air cylinder advances and retracts the honing head for loading clearances. Machine built by National Broach & Machine Co., Detroit, Mich. ▼▼▼

Briefs From Britain

• **Hydraulic Clamping**—Application of Newton power jacks to a multi-drilling fixture has increased oil-sump production at Jaguar Cars Ltd., Coventry, England. Thirty jacks operate simul-

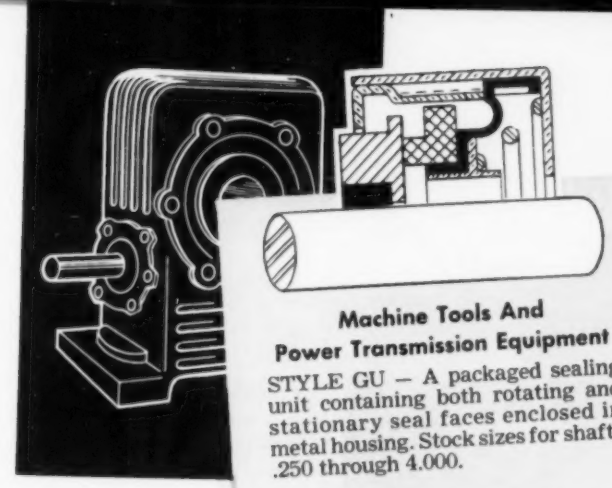


taneously a similar number of forked clamps. Clamping is effected by a single manually operated valve feeding 10 cu in displacement hydro-pneumatic boosters coupled in tandem from air

Continued on page 44

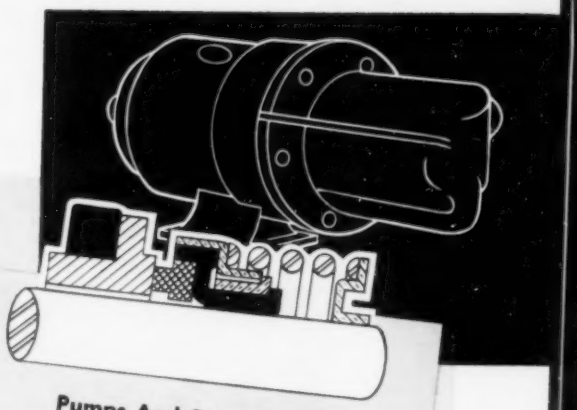
CIRCLE 100 ON TIME-SAVER CARD

CIRCLE 47 →



Machine Tools And Power Transmission Equipment

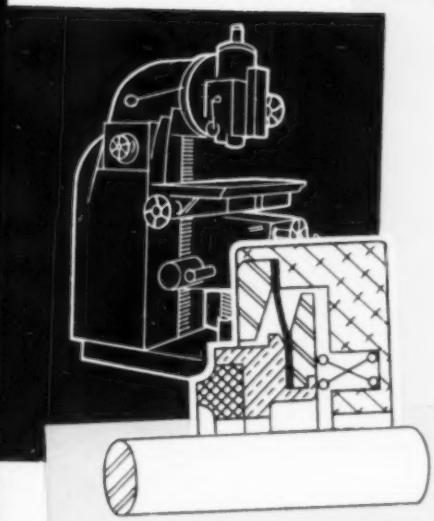
STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.



Pumps And Compressors

ROTO-FLEX — Rugged flexibility. Only 3 parts. Single or double units. Stock sizes for shafts .250 through 4.000.

STYLE RFO — A specially designed Roto-flex seal, for installation outside the stuffing box. Stock sizes for shafts .250 through 4.000.



Heavy Machine Tools

STYLE DPC — A high-speed, carbon-faced seal, for more compact installation in heavy industrial machinery. Stock sizes for shafts .250 through 4.000.

A Complete Line

GITS SHAFT SEALS

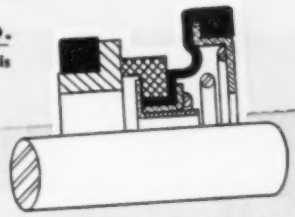
For Every Application

These modern, mechanical, face-type seals are carried in stock — to save you time and money. Write for detailed data.

GITS BROS. MFG. CO.

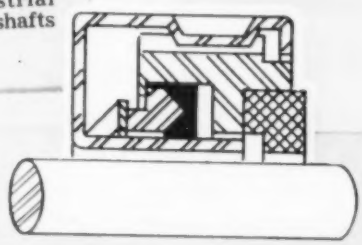
1846 South Kilbourn Avenue • Chicago 23, Illinois

Specialists In Lubricating Devices And Shaft Seals For Almost Half-A-Century



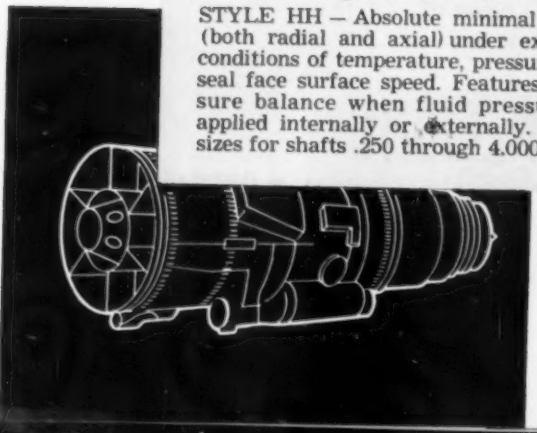
Household Appliances

STYLE SGU—A factory-assembled unit-type seal for the small-budget user. Stock sizes for shafts .250 through 1.000.



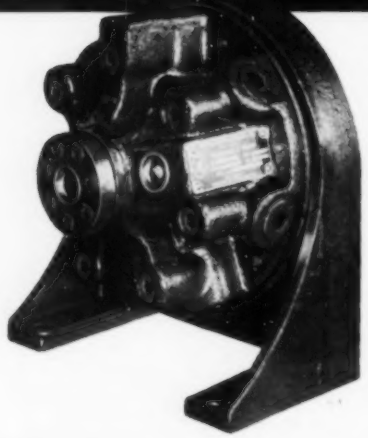
Aircraft Engines And Accessories

STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Stock sizes for shafts .250 through 4.000.



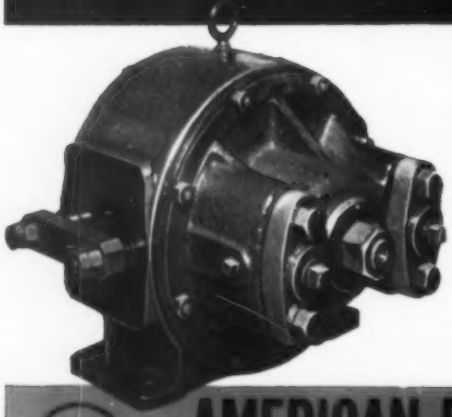
For highest quality
when the pressure's on . . . it's
HELE-SHAW and HYDRAMITE
HYDRAULIC PUMPS

for constant displacement . . .
HYDRAMITE



- Pressures to 5,000 psi
- Capacities of 3, 5, 10 gpm and up
- No supercharging needed
- Efficiencies over 85%
- Either rotation for direct drive

for variable displacement . . .
HELE-SHAW



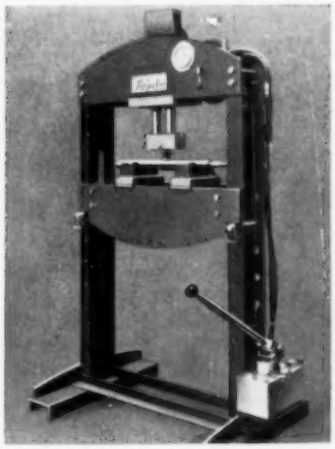
- Instantly reversible
- From 0 to 3,000 psi
- Capacities from 3 to 110 gpm
- Infinitely variable discharge
- Many types of controls

AE **AMERICAN ENGINEERING COMPANY**
Dept. P-141, Wheatsheaf Lane & [illegible], Philadelphia 37, Pa.
CANADIAN SUBSIDIARIES: Affiliated Engineering Corporations, Ltd. Montreal, P. Q. . . . Rowden Industries Ltd., Toronto, Ont.

BRIEFS

supplied at 80 psi. A pressure switch is incorporated in the hydraulic system to prevent the machine being started if pressure drops below a predetermined figure.

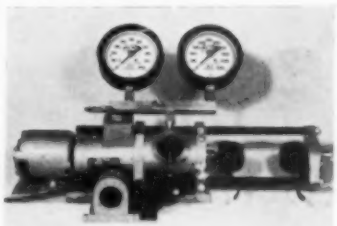
• **Hydraulic Press**—Power is provided by a 3 speed hydraulic hand pump giving a fast approach stroke at low pressure. This 20-ton press can be used for many operations, such as pressing,



stretching, broaching and others. Maximum pressure is 6000 psi. Unit was built by Tubela Engineering Co., Ltd., Ilford, Essex, England. ▼▼▼

Hydraulic Tensile Testing Machine

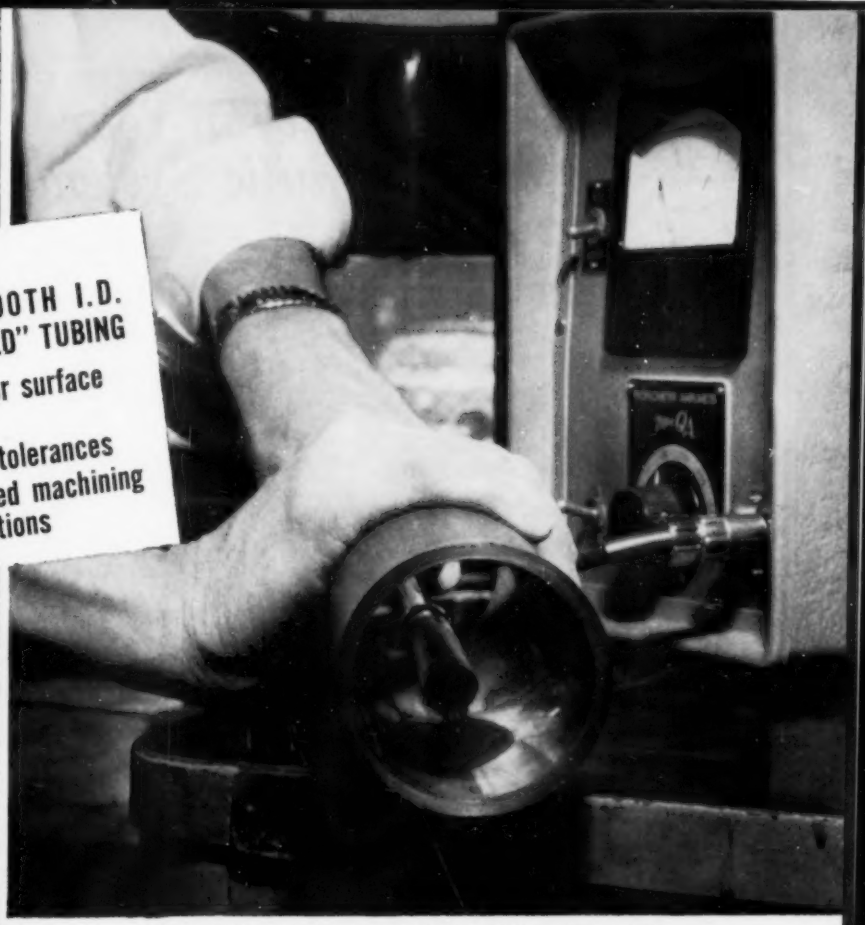
Easy to operate, the motor driven "Cal-Tester" has been designed for testing both metallic and non-metallic materials in rod, strip and sheet form.



• **Hydraulically Operated**—This unit, manufactured by Cal Testing Machine Co., Los Angeles, Calif., is hydraulically oper-

Continued on page 46

Specify J&L
SPECIAL SMOOTH I.D.
"ELECTRICWELD" TUBING
for
- superior surface finish
- exact tolerances
- reduced machining operations



This profilometer test is part of J&L's rigid quality control from ore to finished tubing.

SPECIAL SMOOTH I.D. ELECTRICWELD TUBING

now available with wall thickness to 3/16"

Investigate the possibility of cutting your production costs, improving your products, with this new J&L tubing. The expansion of size range of special smooth Electricweld tubing now permits greater design application of this versatile product. The new wall thickness is made in tubing with inside diameters up to and including 3½ inches.

Special smooth Electricweld tubing has an inside finish superior to most honed surfaces. The mirror-like surface results from J&L's unique drawn-over-mandrel processing method. This eliminates many machining operations and cuts costs in production of hydraulic and pressure cylinders.

For complete information, call your local distributor, or write direct to Jones & Laughlin Steel Corporation, 3 Gateway Center, Pittsburgh 30, Pennsylvania.

J&L STEEL

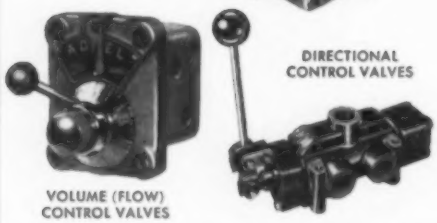
Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA

ADEL *Reliability in Your Hydraulic Systems*

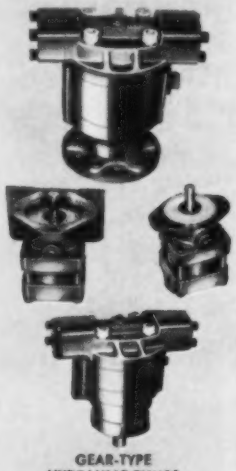
BETTER MACHINE CONTROL...
FOR BETTER MACHINE PERFORMANCE

PILOT OR SOLENOID OPERATED VALVES



DIRECTIONAL CONTROL VALVES

VOLUME (FLOW) CONTROL VALVES



GEAR-TYPE HYDRAULIC PUMPS

New Industrial Gear Type Hydraulic Pumps with capacities from ¼ to 35 GPM at pressures to 1500 PSI and speeds to 3600 RPM.

The diagrams show but two of innumerable circuits and systems where these versatile pumps and control valves can be used to advantage.

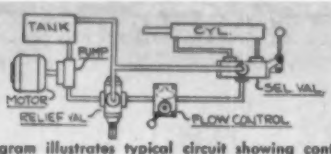


Diagram illustrates typical circuit showing control of cylinder.

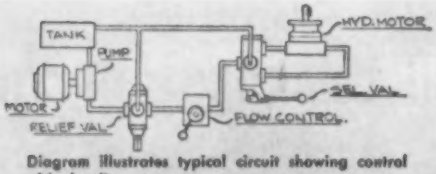


Diagram illustrates typical circuit showing control of hydraulic motor.

For metal working machines, industrial equipment, farm machinery, construction equipment, motor vehicles and marine applications... *Specify* ADEL *Precision-Engineered Hydraulics* for every mechanical operation in every industry.

Complete engineering specifications are available upon request.

Reliability
ADEL PRECISION PRODUCTS
A DIVISION OF GENERAL METALS CORPORATION

1444 WASHINGTON AVENUE, HUNTINGTON 4, WEST VIRGINIA

DISTRIBUTORS:

ARIZONA
Air-Draulics Company
3135 N. 29th Ave., Phoenix

CALIFORNIA
Calpacific Equipment Co.
50 Hawthorne St., San Francisco 5
Teglen Engineering Co., Inc.
1942 Huntington Dr., So. Pasadena

COLORADO
E. C. Wild Company
695 So. Garfield St., Denver 9

CONNECTICUT
Air & Hydraulic Engineering Co., Inc.
96A Howe St., New Haven

INDIANA
Neff Engineering Company
2509 Washington Ave., Evansville
2339 Crescent Ave., Ft. Wayne 3
6101 College Ave., Indianapolis
707 So. Eddy St., South Bend

MASSACHUSETTS
Lincoln Supply Company
53 State St., Boston
340 Main St., Worcester

MICHIGAN
Hydro-Mechanical Supply Co.
510 Shattuck Rd., Saginaw
Industrial Air & Hydraulic Equipment Company
13324 Kercheval Ave., Detroit 15

MINNESOTA
Ringerud Equipment Co.
Edina Branch, Minneapolis

MISSOURI
Corby Supply Company
3942 W. Pine Blvd., St. Louis

NEW JERSEY
Air & Hydraulic Equipment Co.
86 Hudson St., Hackensack

NEW YORK
Tri-State Supply Co.
11 Stone Ave., Brooklyn 33

OHIO
Industrial Air & Hydraulic Equipment Company
308 E. Front St., Perrysburg
Wyatt Sales Corporation
1900 Euclid Ave., Cleveland 15

OREGON
Russ Chamberlin, Inc.
234 S. E. 12th Ave., Portland 14

PENNSYLVANIA
Airline Equipment Co., Inc.
301 E. Hunting Park Ave., Phila.
Frank T. Donnelley Company
P. O. Box 11527, Pittsburgh 38

RHODE ISLAND
Lincoln Supply Company
1139 Main St., Pawtucket

WASHINGTON
Russ Chamberlin, Inc., Seattle

WISCONSIN
Neff Engineering Company
5856 N. Port Washington Rd.
Milwaukee 17

BRIEFS

ated by a direct-connected reversible motor-driven rotary pump. Pulling action is taken directly from the ram or 3 in diameter piston rather than from the push-pull construction through a cross head.

• **Design Features**—To reduce friction to a minimum, piston and guide tube are made of light weight metal and sprayed with a hard alloy, then ground and lapped into a cylinder to a close fit. There are no packings or pressure seals used. Any leakage is carried back to the reservoir. The control valve is of the piston type by-pass valve with Vee grooves for most sensitive adjustments. For compactness, all oil lines and check valves are in the cylinder walls or endplates and the non-pressure side of the cylinder is used for the main reservoir. The forward or idle run of the piston is actuated by vacuum. For this ram speed control feature a second valve receives the oil from a maximum pressure line and controls the flow going into the cylinder, causing the ram to travel from 0-2½ inches per minute. The constant rate-of-load unit is a rheostat-controlled motor driving the main operating valve through a friction drive disc and pulley, assuring uniform loading of the test specimen. ▼▼▼

HAND PUMP on this Flow-Stop pipe squeezer will build up hydraulic pressures to 7500 psi. This pressure exerts a force on the squeeser of 40 ton. It will completely seal off nominal pipe to 2½ in. dia and copper pipe to 3 in. dia. The unit is used by utilities for hot and cold pipe pinching and frequently saves installation of pressure control fittings. Manufactured by Regent Jack Mfg. Co., Downey, Calif.

Fastest in-the-field replacement!

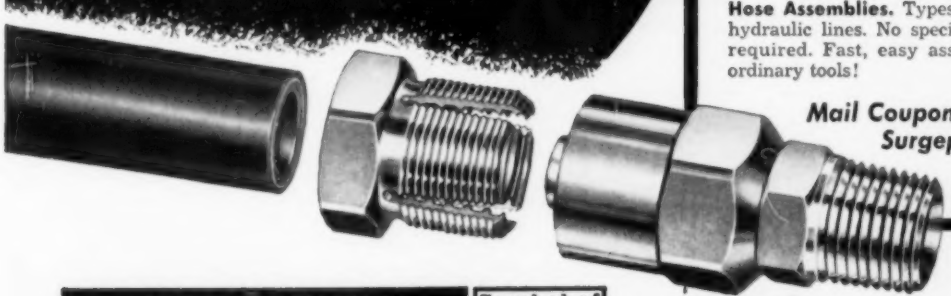
First choice for original equipment!

The Complete Line of

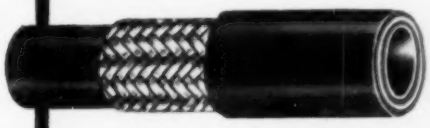
ALEMITE SURGEPRUF

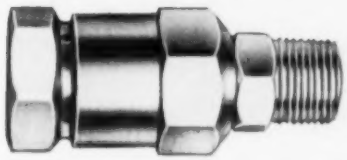
REUSABLE COUPLINGS AND HYDRAULIC HOSE

... with a full line of components nationally available!



Single- and Double-Wire Hose For Medium-High Pressure and High-Pressure Service. Seamless inner tube of synthetic rubber, reinforced steel wire braid, and synthetic rubber outer cover. Resists abrasion, weather, and oil. Hose temperature operating range: −40° F. to +275° F.





Couplings. Made of high-strength steel. "Double-wedge grip" forces coupling threads through rubber cover . . . grips either single- or double-wire braid firmly. Saves both time and labor!

Adapters and Swivel Adapters. Full range of sizes in J.I.C. and other threads. One-piece adapters—and swivel union adapters to simplify assembly and avoid twisting strain in cramped quarters.

Hose Assemblies. Types and sizes for all hydraulic lines. No special assembly tools required. Fast, easy assembly with just ordinary tools!

Mail Coupon for Surgepruf Catalog!

ALEMITE, Dept. EE-78
1350 Diversey Parkway, Chicago 14, Illinois

Please send me your catalogs of Surgepruf couplings, hose and components.

Name .....

Company .....

Address .....

City ..... Zone ..... State .....

ALEMITE
DIVISION
STEWART-WARNER
CORPORATION

Symbol of **SW** Excellence

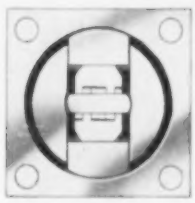
1850 Diversey Parkway, Chicago 14, Illinois

it gives—
and it takes
the higher the pressure—
the better the seal
NOTHING
GETS PAST
Hallprene
Hallprene
the seals that pressure can't lick
HALL &
HALL LTD
OLDFIELD WORKS HAMPTON MIDDLESEX ENGLAND
PATENT

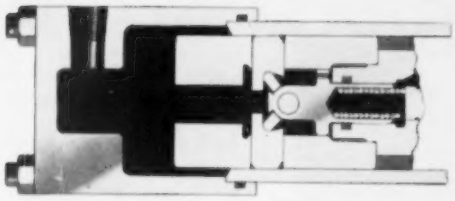
P4309

Announcing— **TOG-LOC® INTERNAL LOCKING HYDRAULIC CYLINDERS*.....**

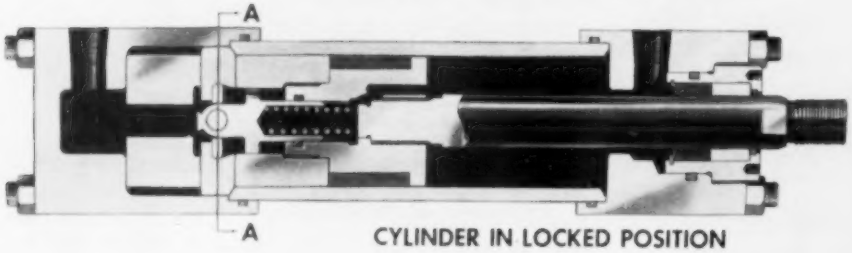
In **LOW-COST** INDUSTRIAL DESIGNS for real simplification of moving and locking mechanisms



SECTION A-A



CYLINDER IN UNLOCKED POSITION



CYLINDER IN LOCKED POSITION

ALL THESE FEATURES—PLUS RUGGED CONSTRUCTION

1. Positive Holding And Unlocking Under High External Loads.
2. Eliminates Costly, Bulky External Linkages Used To Keep Mechanisms Locked In Position.
3. Eliminates The Need To Keep Hydraulic Systems Pressurized During Periods Of No Flow Requirements.
4. Saves Cost, Space And Weight.
5. Simplifies Designs.
6. Increases Reliability.
7. Reduces Maintenance.

LOCKS IN EITHER THE RETRACTED OR EXTENDED POSITION, OR BOTH.

TOG-LOC Cylinders are widely used on aircraft and missile systems—

IMMEDIATE DELIVERY
BORES: 2, 2½ AND 3 INCH—ANY STROKE
PRESSURES: TO 1500 PSI
ADJUSTABLE AND NON-ADJUSTABLE CUSHIONS AVAILABLE
*PATENTED

We invite your inquiry!

TOG-LOC, INC.

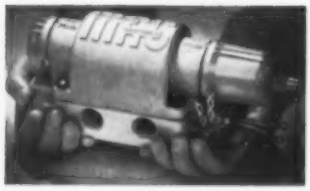
P. O. BOX 735, BELLEVUE, WASHINGTON

Distributorships Available In Most Areas

NEW PRODUCTS

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

SOLENOID VALVE . . . is small and compact



Designation: Dual-spool

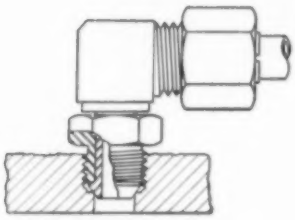
Features: To operate valve, the solenoid moves an inner spool, which releases compressed air to shift the larger outer spool. This pilot type of operation permits the valve and solenoid to be much smaller than would be needed for direct operation. It can be changed from a single to a double-solenoid by removing the retainer head and inserting a solenoid assembly.

Specifications: Valve is made in ½ to 1¼ in pipe sizes and can be operated to 600 cycles per minute. Current required is .8 amp inrush and .125 amp holding at 110 v. Conduit box is built-in to the subplate. Valve meets all JIC specifications.

Mechanical Air Controls, Inc.
Detroit, Mich.

CIRCLE 300 ON TIME-SAVER CARD

STRAIGHT THREAD FITTINGS . . . need no O-ring



Features: Fittings were designed for space saving on hydraulic pumps, valves, cylinders, and manifolds. Two ½-inch fittings can be mounted on one-inch centers.

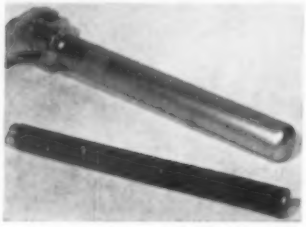
Design: They consist of a swivel body and a floating threaded nut which turns freely on the steam of the body. The floating nut is inserted in a threaded port. As the nut is turned, it bears against a step on the bottom of the stem. Further tightening of the nut forces the conical end of the stem against the bottom of the hole forming a tight metal-to-metal seal.

Specifications: Fittings are made in sizes from ¼ to 2-inch and in all standard shapes.

Flodar Corp.
Cleveland, Ohio

CIRCLE 301 ON TIME-SAVER CARD

OIL FILTER . . . has plastic washer element



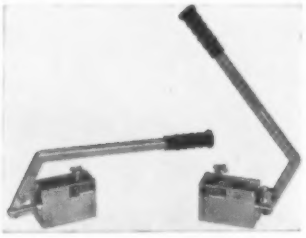
Features: Flow in the filter element is from the outside to the inside through small spaces formed by the surface roughness between adjacent washers. The minimum flow path is 3000 times the rated pore size. Elements will stand pressure surges to 6000 psi.

Specifications: Units have controlled filtration of 2-micron particle size and an absolute filtration of 5-microns. Temperature range -65 to 275 F. Made in 10, 7.5, and 5-gpm sizes. Filter casings are aluminum.

Bendix Filter Division
Bendix Aviation Corp.
Madison Heights, Mich.

CIRCLE 302 ON TIME-SAVER CARD

HAND PUMP . . . is double acting



Designation: Model 2SA

Features: Pump has an operating range of 0 to 10,000 psi. One piston is used to displace high volume low pressure in the first stage, and low volume high pressure in the second stage. A pressure compensating valve built-in the pump cuts out the low pressure stage at a predetermined setting. It also has a safety overload valve to prevent excess pressure in the hydraulic system. The pressure release screw has a vernier which permits accurate control of flow.

Specifications: Displacement is .6 cu in at 3000 psi, .257 cu in at 6000 psi, and .149 cu in at 10,000 psi.

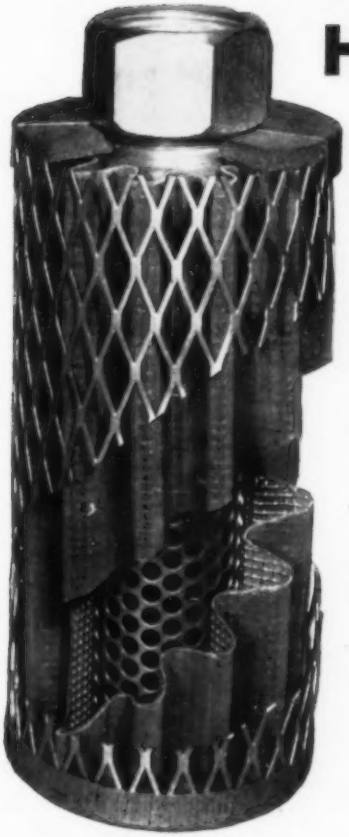
William S. Pine
Los Angeles, Calif

CIRCLE 303 ON TIME-SAVER CARD

Continued on page 52

MARVEL Synclinal FILTERS

For Dependable Protection on HYDRAULIC EQUIPMENT



SUMP TYPE (Cutaway)

Hydraulic Oils MUST BE CLEAN!

**to Protect Equipment—
Increase Production—
Reduce Maintenance**

PRODUCTION ENGINEERS and MAINTENANCE MEN whose job it is to keep production machinery operating at peak efficiency are specifying Marvel Synclinal Filters on all new equipment and standardizing with Marvel's throughout their plants.

**OVER 800
Original Equipment
Manufacturers**

of hydraulically actuated and other equipment utilizing low pressure liquid circulating systems, who have recognized the superiority of Marvel Synclinal Filters, are installing them as standard equipment.

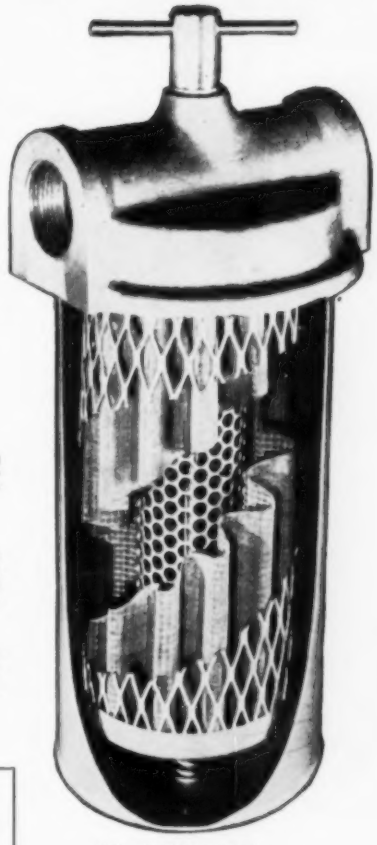
A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G. P. M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of Monel mesh sizes range from coarse 30 to fine 200.

EASY TO CLEAN

Both sump type and line type units are easily disassembled, thoroughly cleaned and reassembled in a matter of minutes. Line type operates at full efficiency in any position and may be serviced without disturbing pipe connections.

Meet J. I. C. Standards



LINE TYPE (Cutaway)

IMMEDIATE DELIVERY

Catalogs contain complete engineering data and dimensional charts making it easy to select a filter for your specific requirements and get Immediate Delivery.

Catalogs containing complete data available on request.

For further information, write, wire, phone or use coupon below

MARVEL ENGINEERING COMPANY
**7227 N. HAMLIN AVE.,
CHICAGO 45, ILLINOIS
Phone: JUNIPER 8-6023**

Without obligation, please send me complete data on Marvel Filters, as indicated: (AH-7)

- ☐ Catalog #108—For Hydraulic Oils, Coolants, Lubricants
- ☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
- ☐ Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic)
- ☐ Catalog #301—For Water

Name _____ Title _____

Company _____

Address _____

City _____ State _____

UCON
BRAND
HYDROLUBES

EP

PROTECTION The fire-resistance of CARBIDE's fire-resistant hydraulic fluids has been proved by severe, exhaustive laboratory tests. And, in actual service, water-base UCON hydrolubes have prevented serious fires and injuries during more than 10 years of routine use in all types of industrial hydraulic equipment. The common fire hazards connected with hydraulic operations are eliminated when UCON hydrolubes are used. UCON hydrolubes are classified as acceptable, less hazardous fluids by Factory Mutual Laboratories.

ECONOMY UCON hydrolubes 150-CP and 275-CP are the economical answer to fire-resistance in hydraulic fluids. Most commercial hydraulic equipment can be easily converted to UCON hydrolubes with a minimum of time and expense. UCON hydrolubes have no harmful effects on most packings or seals. In fact, in many instances, reduced leakage losses have been reported. UCON hydrolubes also provide maximum protection against liquid and vapor phase corrosion and have outstanding anti-wear characteristics—thus, pump replacement costs are also held to a minimum.

Why not get all the facts on how UCON hydrolubes can mean protection plus economy for you. Write today for the booklet, "UCON Hydrolubes Spell Safety," F-40134.

UNION CARBIDE CHEMICALS COMPANY

Division of UNION CARBIDE Corporation

30 East 42nd Street, New York 17, N. Y.

"Ucon" is a registered trade-mark of UCC.

NEW PRODUCTS

LIMIT SWITCHES
. . . are oil-tight

Designation: Loxswitch
Features: Heavy duty, designed for machine tool service where large quantities of oil, dust, and water are encountered. A neoprene gasketed housing, and buna-n shaft

seal keep out contaminants. In a laboratory underwater test, switch operated submerged for over 5,100,000 actuations.
Specifications: Made with 31 contact arrangements, including single pole, double pole, multiple circuit, and neutral position switches. They have 70 deg safety overtravel in either direction.

R. B. Denison Mfg. Co.
Cleveland, Ohio

CIRCLE 304 ON TIME-SAVER CARD

HYDRAULIC CYLINDER
. . . has threaded construction

Features: Made with forged steel heads and with or without adjustable cushions. Use high pressure piston ring construction and have extra long rod guide bearing. Three types of oversized ports are available.

Specifications: Made for operating pressures of 1000, 2000, and 3000 psi. Cylinder barrel is threaded into the end caps eliminating the need for tie-rods, and permitting, the cylinder to fit into the small space.

Tomkins-Johnson Co.
Jackson, Mich.

CIRCLE 305 ON TIME-SAVER CARD

Continued on page 54

CIRCLE 118 ON TIME-SAVER CARD

CIRCLE 120 →

only **U. S. MOTORS**

insulates all windings with asbestos!

your best protection

against
motor burn-out
and
production
shutdowns

Only U.S. offers this protection! ALL windings insulated with asbestos—nature's million-year-old insulating material that *cannot carbonize!* Many motor makers use varnished paper, cloth, oiled linen, press-board, fish-board—even insulating varnish alone. All these will carbonize... not one is fire-proof!

Only the original, patented U.S. ASBESTIC PROCESS—gives you: 1—*Heat resistance*... can't carbonize, 2—*heat conductance* better than any cellulose material, 3—*moisture resistance*... due to exceptional impregnation and coating of windings.

Protect yourself against costly production shutdowns due to motor burn-out! Be sure to specify: "U.S. MOTORS"!

U.S. ELECTRICAL MOTORS INC.

BOX 2058, LOS ANGELES 54, CALIFORNIA
OR MILFORD, CONNECTICUT

FREE COLOR-ILLUSTRATED BROCHURES
For specific data on asbestos protection, write for General and Type H Uniclosed Bulletins.

ITS *flexibility* CUTS COSTS

Use Chemiseal® Nylon Pressure Tubing at a profit. You will find that its low cost—plus the flexible couplings, intermediate fittings and labor it saves—makes the installation a fraction of the cost of metal tubing.

Outperforms Metal

Chemiseal Nylon Pressure Tubing has exceptionally high resistance to flex and vibrational fatigue. It resists abrasion and impact. Is unaffected by oils, hydraulic fluids, alkalies and most solvents. Has service temperature range from −100°F to +225°F. Provides high pressure rating at low cost. Requires no prebending. Utilizes standard metallic flare and compression fittings. Can be installed and fastened around existing equipment.

Made in two grades for 1000 psi and for 2500 psi which conform to J.I.C. specifications for low and medium pressures.

For prompt service, contact one of The Garlock Packing Company's 30 sales offices and warehouses throughout the U.S. and Canada, or write for further information.

United States Gasket Company
Camden 1, New Jersey

United States Gasket *Plastics Division of* **GARLOCK**

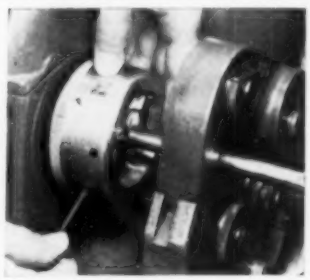
CIRCLE 121 ON TIME-SAVER CARD

NEW PRODUCTS

SQUARING AND BURRING TOOL

. . . for tube flaring machine

Features: The attachment mounts on the company's model 232 power tube flarer. It has an aluminum shell which supports three cutting bits that chamfer the inside and outside edges and square the end of the tubing. Each bit is independent and held with a set screw. Bits are shielded by the body shell to prevent injury from the bits or flying chips. The unit can be used for copper, aluminum, steel, or stainless steel tubing in ⅛ to 2-inch size.



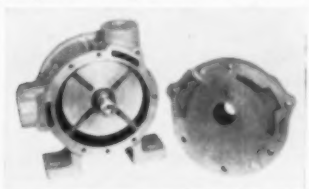
Parker Fittings & Hose Div.
Parker-Hannifin Corp.
Cleveland, Ohio

CIRCLE 306 ON TIME-SAVER CARD

15 PSI AIR PUMP

. . . needs no oil

Features: Pump has a rotary shaft seal which prevents air leaking into the pump or the medium being pumped leaking to atmosphere. The use of the seal allows the pump to be operated without oil.



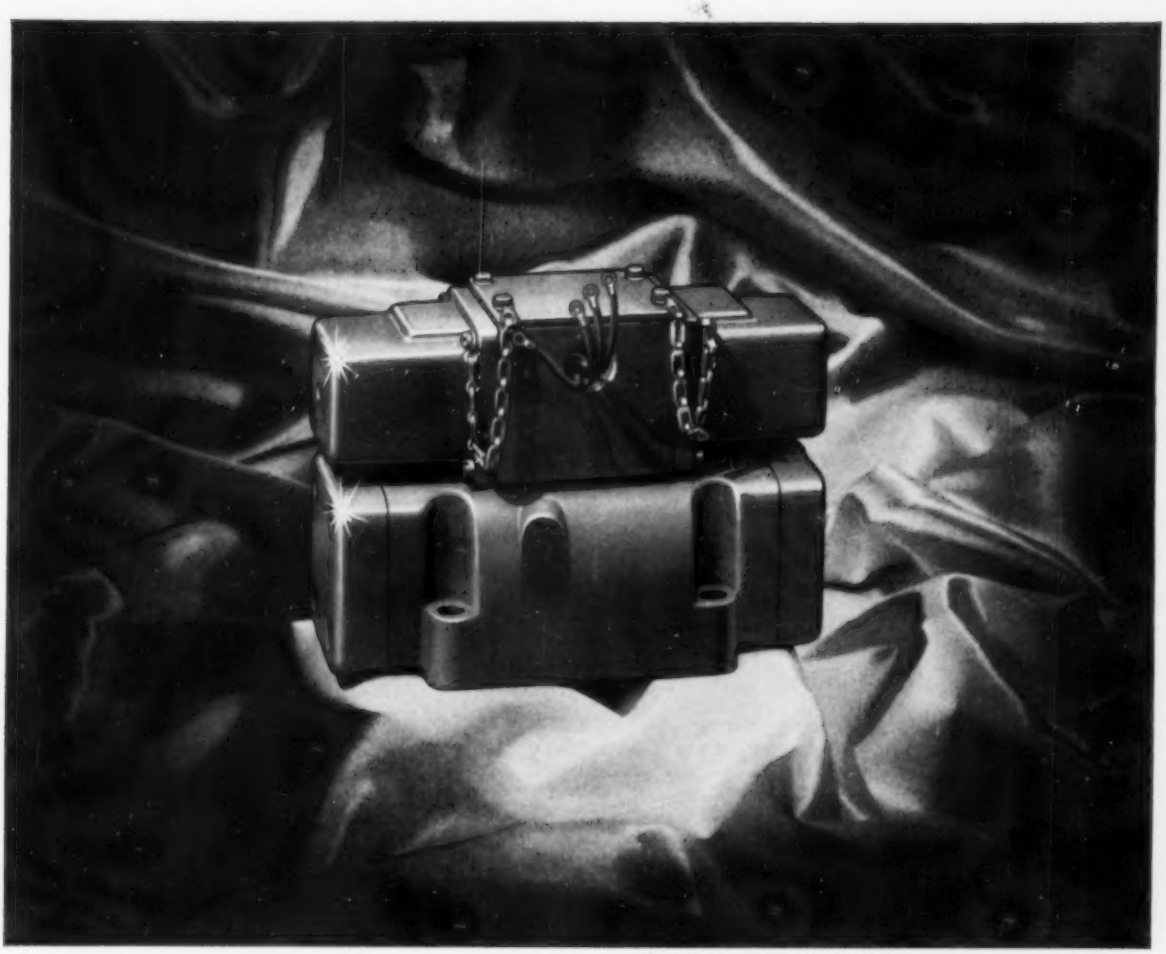
This makes it adaptable for instrument controls where the medium cannot be contaminated with oil.

Specifications: Volume ranges from 2 to 12 cfm with vacuum to 20 in. Hg, or pressures to 15 psi. Pump may be V-belt driven or close-coupled to motor shaft.

Leiman Bros., Inc.
Newark, N. J.

CIRCLE 307 ON TIME-SAVER CARD

Continued on page 57



Illustrated—New 9700 Series
Piggy Back Hydraulic Control Valve.

the ultimate in hydraulic valve design

FREE SEND FOR THE "LOGAN CALCULATOR"
A gift to you from Logansport Machine Company upon request.

MEMBER: Natl. Mach. Tool Builders Assn.; Natl. Fluid Power Assn.

LOGANSPORT MACHINE CO., INC.
832 CENTER AVENUE, LOGANSPORT, INDIANA

PLEASE SEND COPY OF CATALOG:

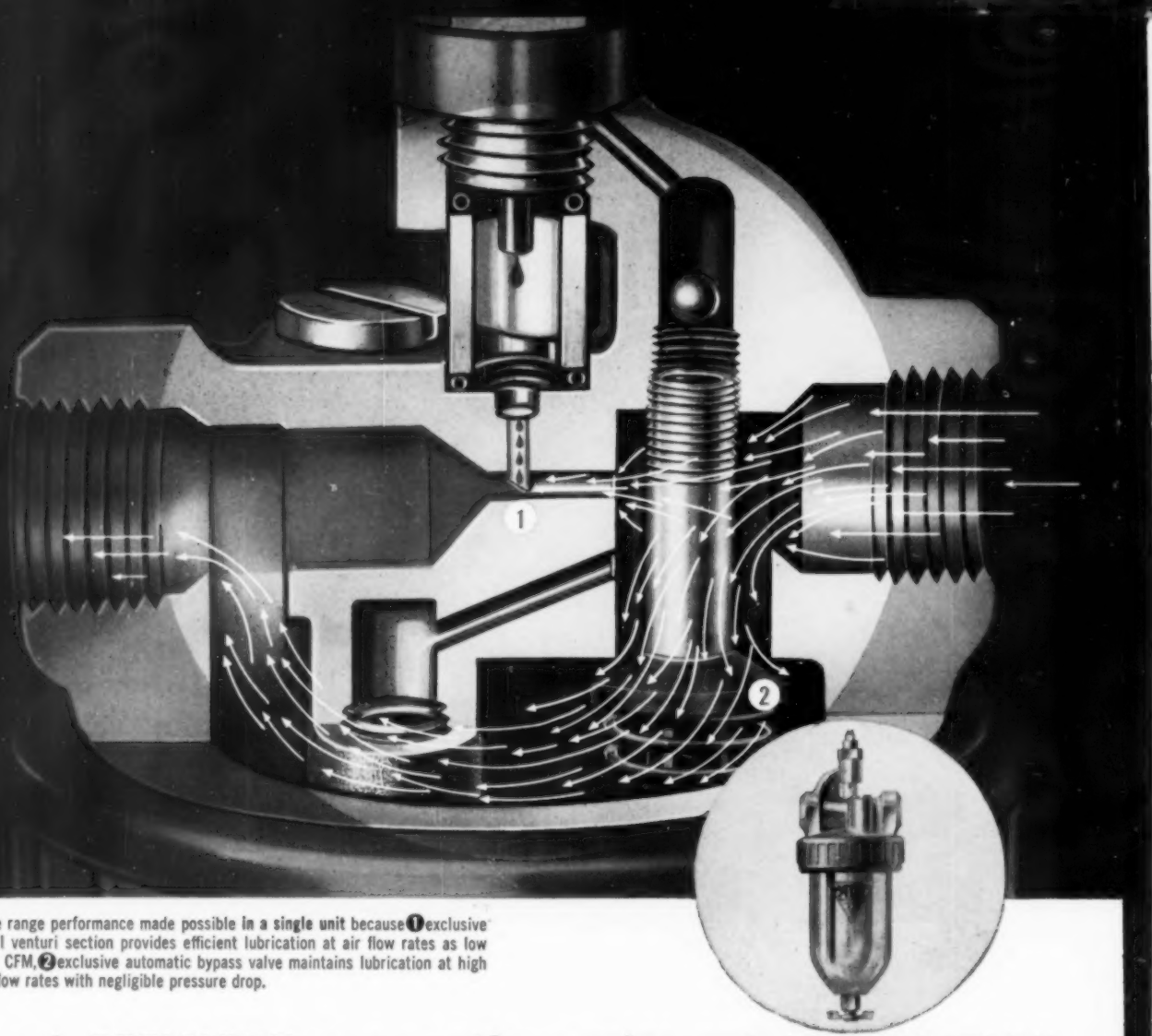
- ☐ 100-1 AIR CYLINDERS
- ☐ 100-2 MILL-TYPE AIR CYLS.
- ☐ 100-3 AIR-DRAULIC CYLS.
- ☐ 100-4 AIR VALVES
- ☐ 100-5 LOGANSQUARE CYLINDERS
- ☐ 100-5-1 ULTRAMATION CYLINDERS
- ☐ 51 PRESSES
- ☐ FACTS OF LIFE
- ☐ 62 SURE-FLOW PUMPS
- ☐ 200-1 HYD. POWER UNITS
- ☐ 200-2 ROTOCAST HYD. CYLINDERS
- ☐ 200-3 750 SERIES HYD. CYLINDERS
- ☐ 200-4 and 200-7 HYD. VALVES
- ☐ 200-6 SUPER-MATIC CYLS.
- ☐ 70-1 CHUCKS
- ☐ ABC BOOKLET
- ☐ CIRCUIT RIDER

TO:

NAME_____ TITLE_____

COMPANY _____

ADDRESS _____



Wide range performance made possible in a single unit because ❶ exclusive small venturi section provides efficient lubrication at air flow rates as low as 1 CFM, ❷ exclusive automatic bypass valve maintains lubrication at high air flow rates with negligible pressure drop.

Now! EFFICIENT pneumatic equipment LUBRICATION AT ALL AIR FLOW RATES

Enough oil — but not too much. A fine mist at *any* flow rate . . . ultra-fine, enduring atomization that assures *efficient* lubrication. Tools, chucks, cylinders, other air equipment function smoothly at *any* speed when lubricated by Watts air line lubricators.

You get optimum efficiency from these advanced-design units because Watts has *specialized* in protection and control devices since 1875. Exclusive features and precision construction assure reliable, lowest-cost performance.

WATTS FILTERS — exclusive "TORNADO ACTION" provides really clean dry air

Filter life is extended by extreme centrifugal force which spirals dirt and moisture particles downward into "quiet zone", leaving only a minute percentage of the finest and lightest particles to be trapped by the filter cone.

WATTS REGULATORS — sensitive "Aspirator Action" maintains more uniform pressure

Aspirator acts directly on diaphragm giving instant compensation for fluctuating load demands . . . provides precise control and stabilizes pressures reaching individual pieces of equipment.

Write for free technical catalog. Charts, diagrams, performance data enable you to specify the right Watts pneumatic equipment right on the spot!

WATTS FILTERS REGULATORS LUBRICATORS — YOUR SAFE SPECIFICATION

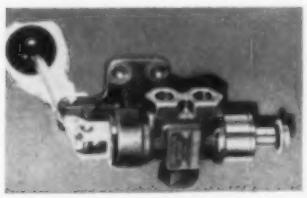
Watts Regulator Company — Industrial Division — 6 Embankment Road — Lawrence, Massachusetts

USEFUL

NEW PRODUCTS

LEVER-OPERATED VALVE . . . has foot bracket end section

Features: Designed for concealed mounting behind or below control panels the valve has a short lever



throw. It has unrestricted flow. Area through the valve is equal to nominal pipe size.

Specifications: Made in ¼ to 1-inch size. Bodies are cast bronze and stems are chrome plated stainless steel. Straight-through construction permits easy replacement of packing. Made for air or hydraulic service.

Valvair Corp.
Akron, Ohio

CIRCLE 308 ON TIME-SAVER CARD

IN-LINE FLOW REGULATOR . . . has calibrated adjustment

Features: Flow is varied by turning a sleeve on the valve body. The sleeve is calibrated to allow accurate repeat settings. Regulator is pressure compensated and has a

built-in check valve for free flow in the reverse direction. A set screw provides positive locking of the regulator. Accuracy of the unit is 5 to 15 percent of flow setting.

Specifications: Made in ¼, ⅜, and ½-in. pipe sizes for flow rates of 5, 10, and 18 gpm. Maximum pressure rating is 3000 psi.

Fluid Power Accessories, Inc.
Glenview, Ill.

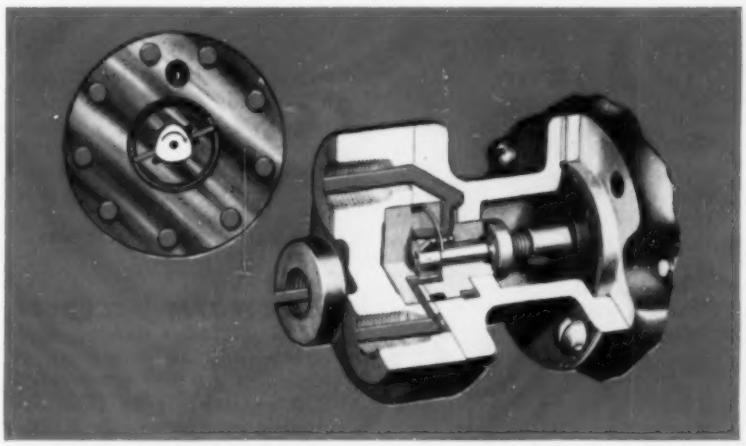
CIRCLE 309 ON TIME-SAVER CARD

For more NEW PRODUCT reviews turn to page 114

YESTERDAY'S PIONEER . . . TODAY'S LEADER

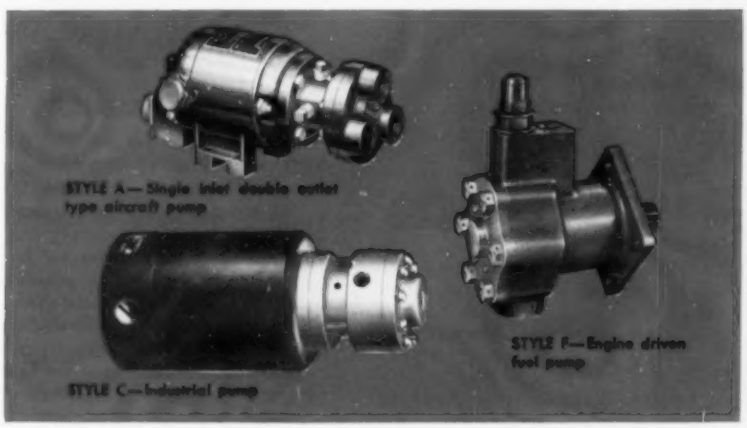
WELDON / **FLUID METERING PUMPS**

Positive Displacement Rotor Type. For Industrial Applications, Aircraft Anti-Icing and Aircraft Fuel.



IT'S SO SIMPLE!

The rotation of the rotor draws the fluid in through two passages, filling the cavities formed by the three lobes of the rotor. This fluid is sealed within these small cavities until it is forced through the two outlet holes by the floating blades. The flow may be kept uniformly divided through two outlet ports, or may be combined internally for passage through a single port.



COMPACT • LIGHT WEIGHT

Send for Weldon Manual and Catalog with detailed specifications and installation drawings, covering the full range of Weldon pumps in various capacities. Specify your requirements.

60 YEARS OF LEADERSHIP 1918—1958

THE WELDON TOOL COMPANY

3000 WOODHILL ROAD . . . CLEVELAND 4, OHIO

CIRCLE 133 ON TIME-SAVER CARD

← CIRCLE 130

SNAP-TITE REMOTE CONTROL COUPLINGS

USEFUL LITERATURE

For your free copy of publications reviewed, fill in the reader service card

HYDRAULIC SERVO . . . which started life as a power steering device for mobile equipment is described in literature from *Behlen Manufacturing Co., Columbus, Nebr.* Bulletin shows a sectional view of this rotary unit which includes the servo and motor. Power is supplied by a gear pump having a preset relief valve at 850 psi. Unit's characteristics offer many possibilities for other types of machinery.

CIRCLE 400 ON TIME-SAVER CARD

HYDRAULIC POWER UNIT . . . designed to eliminate down time is shown in a bulletin sheet issued by *Double A Products Company, Manchester, Michigan.* Photographs show construction which permits quick access to components. Unit is designed for lift truck and crane pickup.

CIRCLE 401 ON TIME-SAVER CARD

AIR VALVES . . . and circuit information are given in Digest Catalog 58 available from *Ross Operating Valve Co., Detroit, Mich.* The 20-page catalog gives basic information on methods of controlling air. Drawings show valve arrangement and installation. Cutaway drawings show construction and operation of the broad valve line.

CIRCLE 402 ON TIME-SAVER CARD

O-RING REFERENCE TABLES . . . have been published in a 16-page booklet by *E. F. Houghton & Co., Philadelphia, Pa.* The tables combine the recently adopted ARP 568 System and supplies cross reference data between the Uniform sizes and former Houghton "S" sizes. Also presented are cross references sizes for government drawings of the AN, MS, and CKCX series. The ARP 568 system is based on I.D. and cross-section of the ring. It eliminates drawing numbers of the various suppliers. O-rings will be ordered by common series of numbers regardless of supplier.

CIRCLE 403 ON TIME-SAVER CARD

BLADDER-TYPE ACCUMULATORS . . . their different applications, sizes and types are described in a 6-page brochure PR-200 available from *Greer Hydraulics, Inc., Jamaica, N. Y.* Both

the standard 3000 psi line and the 6000 psi line of hydro-pneumatic accumulators are illustrated. Included are eight basic accumulator circuit applications dimensional data, selection information for hydraulic circuits requiring pressure storage, primary power reduction, emergency power, pressure-volume compensation, shock absorbtion, leakage compensation, transfer barriers and fluid dispensing.

CIRCLE 404 ON TIME-SAVER CARD

INTERCHANGEABLE CYLINDERS . . . a new line developed by *The Sheffer Corporation, Cincinnati, Ohio* is described in Bulletin 558. These stressed tie rod, air and low pressure hydraulic cylinders meet or exceed J.I.C. standards in 12 bore sizes for from 1-⅛ to 14 in. Complete construction, dimensional and operating pressure data is given for this C-5 series of cylinders.

CIRCLE 405 ON TIME-SAVER CARD

SYSTEMS AND UNITS . . . designed by *General Regulators Corporation, New York, N. Y.*, are illustrated in Bulletin GR-58-4. Standard and custom-built hydraulic power units for all ranges of pressures and deliveries are shown. Hydraulic control circuitry for programming, sequencing, timing, remote positioning, are described.

CIRCLE 406 ON TIME-SAVER CARD

BRASS FITTINGS . . . for hydraulics are described in a catalog available from *Span Brass Manufacturing Co., Inc., Otsego, Mich.* Charts give dimensions for couplings, nuts, sleeves, tees, elbows manufactured to S.A.E. Hydraulic Fitting Standards. Price list is included.

CIRCLE 407 ON TIME-SAVER CARD

AIR COMPRESSORS . . . in sizes of ½ to 150 hp are detailed in Catalog 5510 published by *Schramm Inc. West Chester, Pa.* Specification charts, dimensional information, installation and accessories are included in this 16-page booklet.

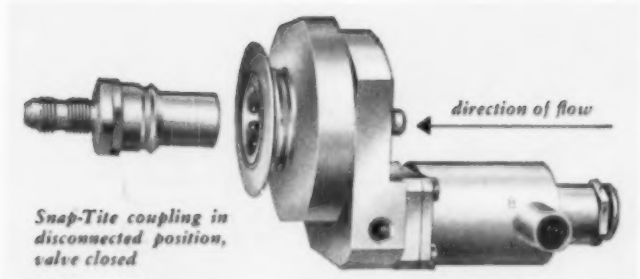
CIRCLE 408 ON TIME-SAVER CARD

HYDRAULIC FILTERS . . . made by *Alsop Engineering Co., Milldale, Conn.* are described in an 8-page bulletin. Design of this "Disc-Pak" filter is shown. Charts give flow rates, particle size removal, moisture removal.

CIRCLE 409 ON TIME-SAVER CARD

For more reviews of FREE LITERATURE turn to page 124

SNAP-TITE REMOTE CONTROL COUPLINGS FOR GUIDED MISSILES



Snap-Tite coupling in disconnected position, valve closed

Here is a specially designed Snap-Tite quick-connect, quick-disconnect coupling, ideal for use in missile-fueling systems. This unit is specifically designed to be manual-connected . . . can also be disconnected manually, or by use of an air-actuated remote control.

NOT A DROP SPILLED!

When the coupling is disconnected, it spills only that small amount of fluid which clings to the metal. The valves in both the coupler and nipple automatically shut off when disconnected, *with no leakage.*

NO AIR INCLUSION!

Coupling operation encloses only a minute amount of air.

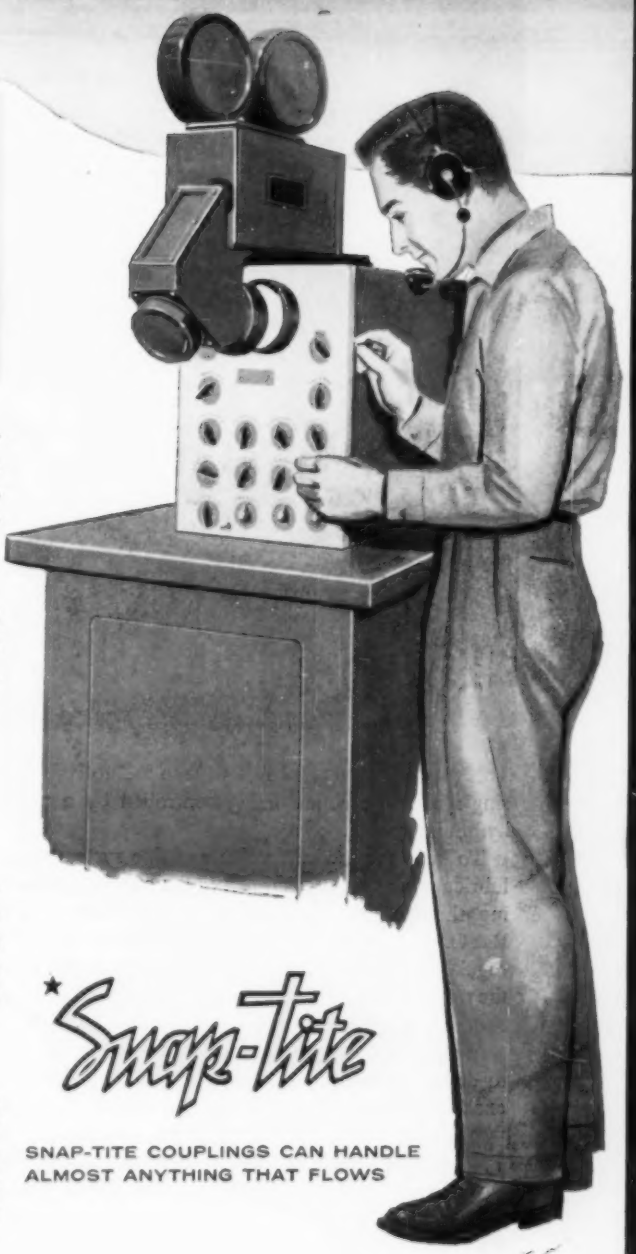
MINIMUM PRESSURE DROP!

Smooth, streamlined passages assure maximum flow.

Variations of this coupling, to meet your required specifications, can be furnished with the appropriate seals to handle liquified gasses, exotic fuels, and a large variety of fluids with working pressures up to 3,000 PSI and temperatures from −300°F to +400°F. Units have been designed up to and including 5″ size.

STANDARD COUPLINGS, TOO!

Your coupling needs might not be as critical as the coupling shown here, but you can be sure, when buying standard Snap-Tite couplings, that the same outstanding engineering and manufacturing skills are basic throughout the Snap-Tite line. Write for complete catalog . . . or describe your specific coupling problems. **Snap-Tite, Inc., Union City 1, Pa.**



★Snap-tite

SNAP-TITE COUPLINGS CAN HANDLE ALMOST ANYTHING THAT FLOWS

USEFUL LITERATURE

For your free copy of publications reviewed, fill in the reader service card

HYDRAULIC SERVO . . . which started life as a power steering device for mobile equipment is described in literature from *Behlen Manufacturing Co., Columbus, Nebr.* Bulletin shows a sectional view of this rotary unit which includes the servo and motor. Power is supplied by a gear pump having a preset relief valve at 850 psi. Unit's characteristics offer many possibilities for other types of machinery.

CIRCLE 400 ON TIME-SAVER CARD

HYDRAULIC POWER UNIT . . . designed to eliminate down time is shown in a bulletin sheet issued by *Double A Products Company, Manchester, Michigan.* Photographs show construction which permits quick access to components. Unit is designed for lift truck and crane pickup.

CIRCLE 401 ON TIME-SAVER CARD

AIR VALVES . . . and circuit information are given in Digest Catalog 58 available from *Ross Operating Valve Co., Detroit, Mich.* The 20-page catalog gives basic information on methods of controlling air. Drawings show valve arrangement and installation. Cutaway drawings show construction and operation of the broad valve line.

CIRCLE 402 ON TIME-SAVER CARD

O-RING REFERENCE TABLES . . . have been published in a 16-page booklet by *E. F. Houghton & Co., Philadelphia, Pa.* The tables combine the recently adopted ARP 568 System and supplies cross reference data between the Uniform sizes and former Houghton "S" sizes. Also presented are cross references sizes for government drawings of the AN, MS, and CKCX series. The ARP 568 system is based on I.D. and cross-section of the ring. It eliminates drawing numbers of the various suppliers. O-rings will be ordered by common series of numbers regardless of supplier.

CIRCLE 403 ON TIME-SAVER CARD

BLADDER-TYPE ACCUMULATORS . . . their different applications, sizes and types are described in a 6-page brochure PR-200 available from *Greer Hydraulics, Inc., Jamaica, N. Y.* Both

the standard 3000 psi line and the 6000 psi line of hydro-pneumatic accumulators are illustrated. Included are eight basic accumulator circuit applications dimensional data, selection information for hydraulic circuits requiring pressure storage, primary power reduction, emergency power, pressure-volume compensation, shock absorbtion, leakage compensation, transfer barriers and fluid dispensing.

CIRCLE 404 ON TIME-SAVER CARD

INTERCHANGEABLE CYLINDERS . . . a new line developed by *The Sheffer Corporation, Cincinnati, Ohio* is described in Bulletin 558. These stressed tie rod, air and low pressure hydraulic cylinders meet or exceed J.I.C. standards in 12 bore sizes for from 1-1/8 to 14 in. Complete construction, dimensional and operating pressure data is given for this C-5 series of cylinders.

CIRCLE 405 ON TIME-SAVER CARD

SYSTEMS AND UNITS . . . designed by *General Regulators Corporation, New York, N. Y.,* are illustrated in Bulletin GR-58-4. Standard and custom-built hydraulic power units for all ranges of pressures and deliveries are shown. Hydraulic control circuitry for programming, sequencing, timing, remote positioning, are described.

CIRCLE 406 ON TIME-SAVER CARD

BRASS FITTINGS . . . for hydraulics are described in a catalog available from *Span Brass Manufacturing Co., Inc., Otsego, Mich.* Charts give dimensions for couplings, nuts, sleeves, tees, elbows manufactured to S.A.E. Hydraulic Fitting Standards. Price list is included.

CIRCLE 407 ON TIME-SAVER CARD

AIR COMPRESSORS . . . in sizes of ½ to 150 hp are detailed in Catalog 5510 published by *Schramm Inc. West Chester, Pa.* Specification charts, dimensional information, installation and accessories are included in this 16-page booklet.

CIRCLE 408 ON TIME-SAVER CARD

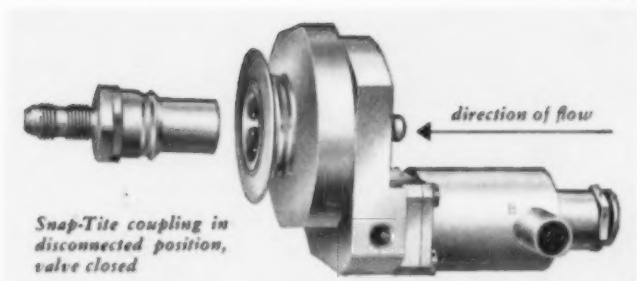
HYDRAULIC FILTERS . . . made by *Alsop Engineering Co., Milldale, Conn.* are described in an 8-page bulletin. Design of this "Disc-Pak" filter is shown. Charts give flow rates, particle size removal, moisture removal.

CIRCLE 409 ON TIME-SAVER CARD

For more reviews of FREE LITERATURE turn to page 124

CIRCLE 106 →

SNAP-TITE REMOTE CONTROL COUPLINGS FOR GUIDED MISSILES



Snap-Tite coupling in disconnected position, valve closed

Here is a specially designed Snap-Tite quick-connect, quick-disconnect coupling, ideal for use in missile-fueling systems. This unit is specifically designed to be manual-connected . . . can also be disconnected manually, or by use of an air-actuated remote control.

NOT A DROP SPILLED!

When the coupling is disconnected, it spills only that small amount of fluid which clings to the metal. The valves in both the coupler and nipple automatically shut off when disconnected, *with no leakage.*

NO AIR INCLUSION!

Coupling operation encloses only a minute amount of air.

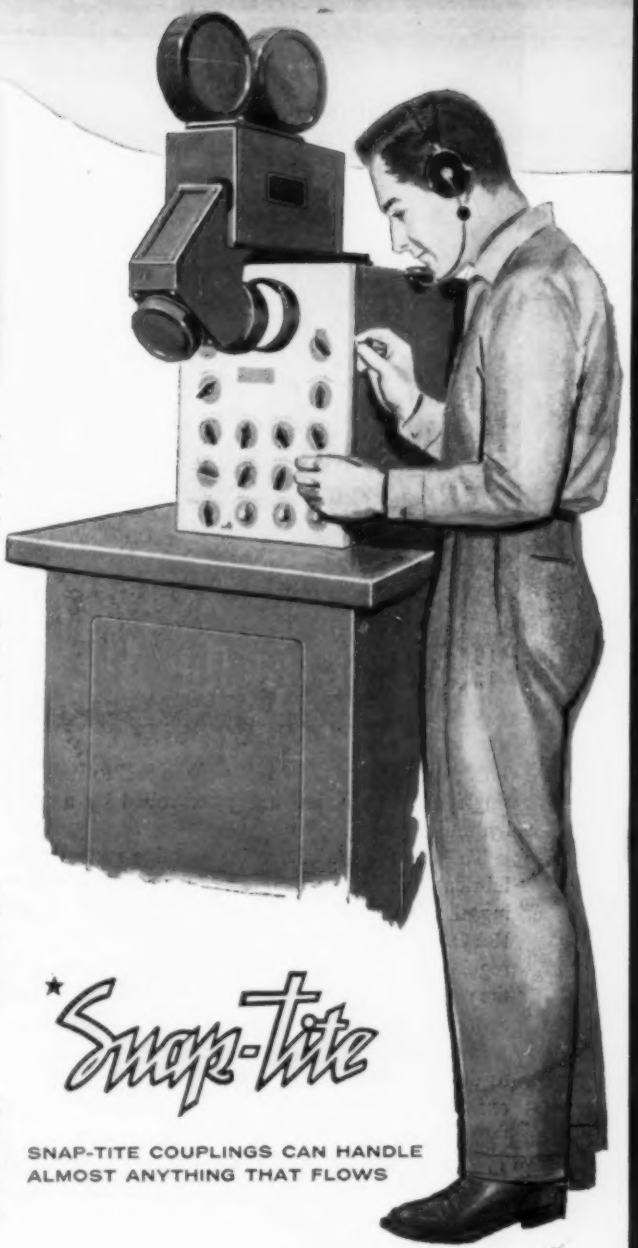
MINIMUM PRESSURE DROP!

Smooth, streamlined passages assure maximum flow.

Variations of this coupling, to meet your required specifications, can be furnished with the appropriate seals to handle liquified gasses, exotic fuels, and a large variety of fluids with working pressures up to 3,000 PSI and temperatures from −300°F to +400°F. Units have been designed up to and including 5″ size.

STANDARD COUPLINGS, TOO!

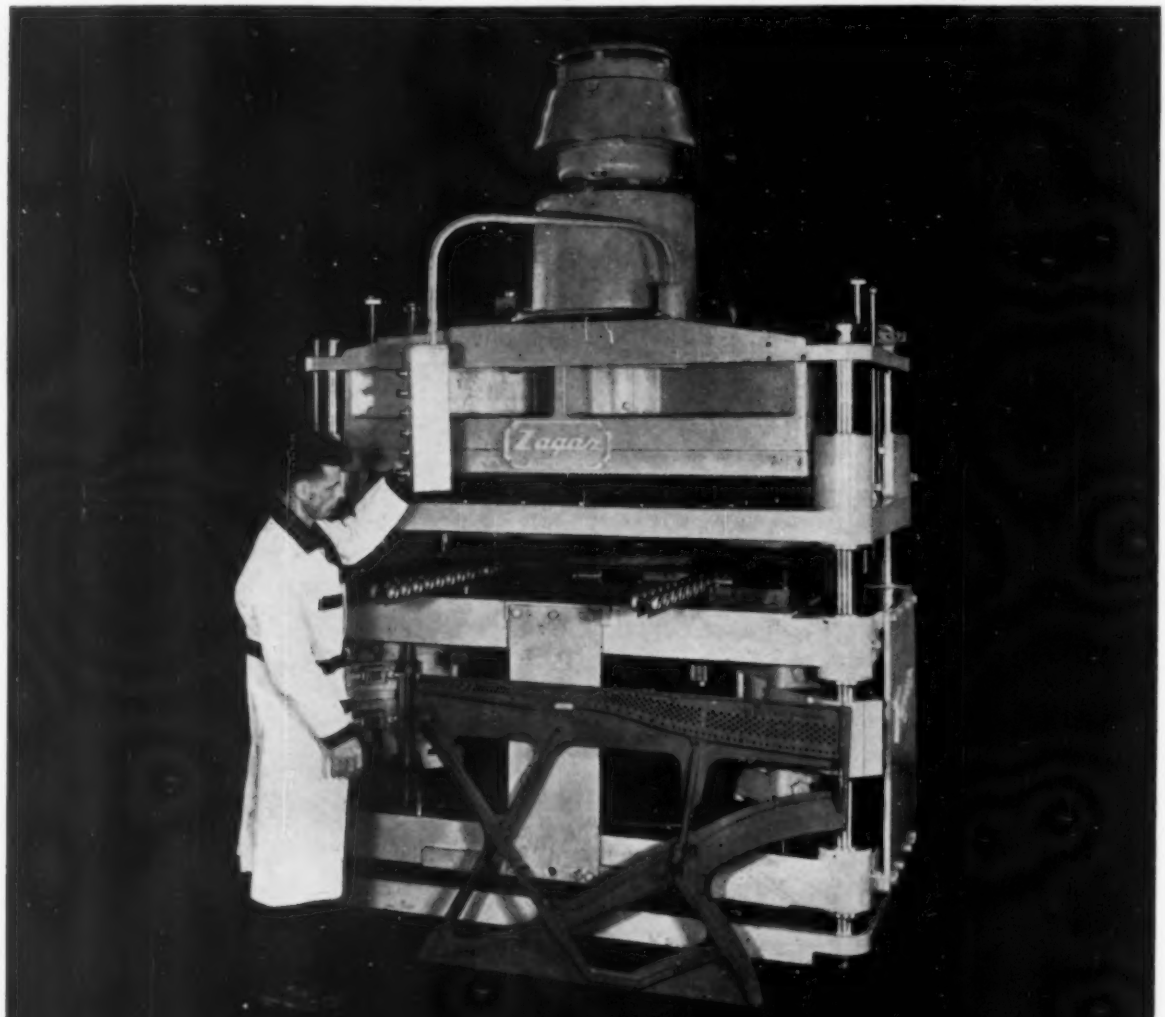
Your coupling needs might not be as critical as the coupling shown here, but you can be sure, when buying standard Snap-Tite couplings, that the same outstanding engineering and manufacturing skills are basic throughout the Snap-Tite line. Write for complete catalog . . . or describe your specific coupling problems. **Snap-Tite, Inc., Union City 1, Pa.**



★Snap-Tite

SNAP-TITE COUPLINGS CAN HANDLE ALMOST ANYTHING THAT FLOWS

Factory fill is Texaco Regal Oil R&O both as spindle lubricant and as hydraulic power medium.



HOW TO DRILL A CAST IRON HARP IN ONE SHOT

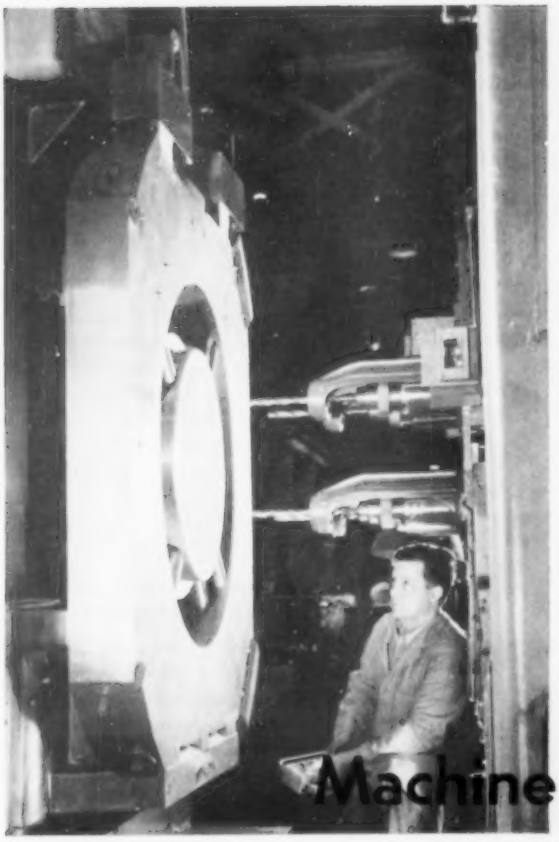
This machine drills 417 holes (from 3/32" to 7/16") all in a single bite, the action being controlled by a powerful hydraulic system.

To keep the intricate valve and line system clean, to lubricate the spindles and assure their accurate functioning, the manufacturer specifies use of Texaco Regal Oil R&O. It has much greater oxidation resistance than regular machine oils. It prevents rust and foam. It keeps the machine's action smooth and effective. And, from the economy standpoint, it has a far longer service life.

Whatever your hydraulic equipment—from giant press to delicate control—there is a Texaco Regal Oil R&O exactly suited for the job. Call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, New York.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)



Machine Tool Forum

DRAWN by a common interest in designing better machine tools, over 150 designers, maintenance supervisors, and production engineers gathered in Detroit last May as guests of Vickers, Inc. Following past forums on hydraulic systems for machine tools, fabricating machinery, and aircraft, the discussion was on questions submitted by machine tool builders, users, and component suppliers. These were answered by prepared remarks followed by open discussion. Rather than the cut-and-dried atmosphere of many technical conferences, this one teemed with a free interchange of ideas. Here is a brief run-down.

- **How fast can a pressure-compensated pump move from deadhead to full volume position?**

Standard, axial piston, pressure-compensated pumps have a recovery time of about 1 second, stated Lou Jordan of Vickers. However, they can be modified for faster rates, and the smaller sizes can be cut down to about 1/5 second. Because this requires opening an orifice which bleeds off oil during deadhead, there's a loss of efficiency in speeding up recovery. Vane pumps are generally faster than piston pumps. Although a 30-gpm vane pump has a recovery time of .05 second compared to .3 second for a modified piston pump of the same capacity, the lower pressure rating of the vane pump limits its output to about 13 hp. A smaller piston pump with a recovery time of .1 second operating at higher pressure could deliver this same power. Other considerations in making a selection are the flatter cut-off pressure and higher efficiency of the piston pump.

• What are the features of a hi-lo pump arrangement vs. pressure compensation?

Most of the decision whether to use one or the other depends on the application, explained Vickers' Bob Erskine. Where pilot pressure is required for shifting valves, a 50 or 65-psi check valve can be connected with the hi-lo system, so that only the small volume pump delivers through this valve. Where clamps require a sequence valve to assure minimum pressure during rapid traverse, only delivery of the low volume pump needs to be sequenced, with the sequence valve set higher than the pump unloading valve. Milt Fox of Vickers described a soon-available combination (hi-lo) pump with a recovery time about the same as a pressure-compensated pump. It has a very small, low volume pump and one adjustment for both the relief valve and the unloading valve. This prevents setting them too close together and having a partially open unloading valve.

MODERATORS for the two day meeting were J. R. Cypher, Plant Manager, Chrysler Kokomo, and K. O. Tech, Engineering Vice President, The Cross Company.

• How does torque vary as a fluid motor rotates?

In tests at 1 rpm with strain gages for measuring, the torque variation of a gear motor was 23% of theoretical torque, of a vane motor, 15%; and of a piston motor, 7%. Torque varied quite sharply in the gear motor. Torque variation in the vane motor was quite smooth and approached a sine wave. In the piston motor variation was very smooth. The piston motor could be modified to reduce torque variation almost to zero. A method of balancing out torque variations is to couple two motors together, so they are 20-degrees out of phase. With both motors having 9 pistons, this gives the effect of an 18-piston motor and gives half the magnitude of pulsation. Answering the question whether an accumulator at the inlet of the motor would help smooth out torque variations, Lou Jordan said not appreciably, because pressure changes are not the main cause of torque variation.

• What efficiency can be expected from a fluid motor?

Showing curves of piston, vane, and gear pumps, Vickers' Ed Gatwood gave performance figures. Volumetric efficiency of the piston motor approaches 98% at 1800 rpm and 1000 psi, overall efficiency is about 92% at 1000 rpm. Leakage in a vane pump is higher, so the volumetric efficiency curve is fairly steep, reaching about 90% at 1800 rpm. Maximum overall efficiency is 74% at 1600 rpm. The gear motor has a volumetric efficiency of 94% at 1800 rpm. Overall efficiency reaches a peak of 81% at about 1050 rpm. Continuing the discussion of fluid motors, Art Phillips of Chrysler told of motor breakage caused by pressure surges during deceleration. R. K. Sedgwick of Kearney & Trecker described his use of relief valves to limit back pressure during deceleration.

• What are the wear problems with emulsion type fire resistant fluids?

In a survey of 15 users and 60 hydraulic systems, results with this fluid were good. Most users had changed suction conditions for the higher viscosity design replacing 100-mesh strainers with 50-mesh. There was some trouble from cavitation with cold fluid, but not after the fluid warmed up. Vickers' Ron Kordenbrock and Monsanto's Richard Davis both agreed that about 5% of the hydraulic fluid now used is fire resistant. Outlining his experience, Ed Lerczak said that he has done some modification of cup packings to get smooth operation with this fluid. Amplifying this, Houghton's Harold Blair described work done on cup packings for feed cylinders. Much depends on how they are installed. Too much squeeze forces out the heel. A spring mounting with about 4 psi on the bottom of the cup eliminates chatter. Other experiences came from Art Phillips who said he had trouble with cups in feed cylinders and was changing over to piston rings.

• Slow Feed Control

Outlining design practices in metering less than 10 cipm of oil, hydraulic engineer Glea Hyland of Sunstrand Machine Tool emphasized the importance of accounting for all oil in the control circuit. You should use as few components as possible, and they should be leakproof, he said. Too often the flow control valve is the first thing blamed for a poor feed motion though the fault may be in another part of the system. He described a method of interchanging connections to the pump and tank ports of a 4-way, directional valve to reduce leakage.

Concluded on page 96

Ideas for machine tools

Nothing is more important in a design office than ideas. Whether a machine is a simple hand tool or a complex numerically controlled miller, it is built from ideas. So the top notch designer not only has to have years of progressive experience, but he must constantly find and generate new ideas. The following pages contain such design ideas taken from the hydraulic and pneumatic systems of machine tools. You'll find systems for tool feeding, indexing, clamping, and spindle driving.

Drum switch controlled indexing

SNYDER TOOL CO.

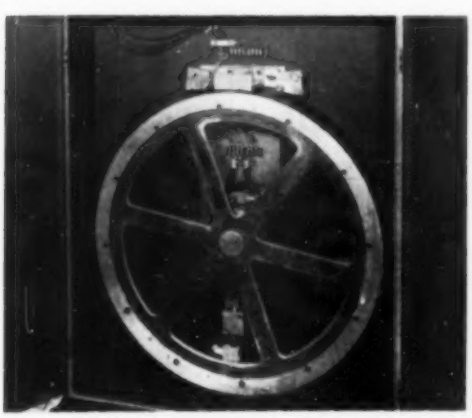
• By Hy Cutler

WHEN 19 different parts must be made on the same index table, a quick and easy way to vary the index interval is a real necessity. Snyder Tool and Engineering managed it with a hydraulically driven index table controlled by a drum switch and four shot pins. The four shot pins are engaged or disengaged by hydraulic cylinders controlled by the drum switch and limit switches. Three rows of shot holes in the index tables are slightly displaced from one another to increase the number of index positions.

• **Electronic Relays**—They're used with the drum switch so that very small currents have to be handled. Drum switch contacts are just rivets which energize the relays by shorting a connection to ground when they touch a contact strip. Drum cost is reasonable and drums can be quickly changed to make a new part. There are six contact strips at the top of the drum, one for each of the four shot-pin cylinders and one for each of the two machining heads. Drum and table are positively synchronized because they're driven by the same hydraulic motor.

• **Operation**—With the table and drum switch turning, a position is reached where the switch contacts stop the table, energize the machining heads and engage the right shot pin. When the machining operation is done, feed cylinders retract, and limit switches energize solenoids to withdraw the shot pin and restart the table and drum. When the correct index interval is reached, the process repeats. ▼▼▼

HY CUTLER, *Control Engineer, Snyder Tool and Engineering Co., Detroit, Mich.*



Tailstock speed and force control

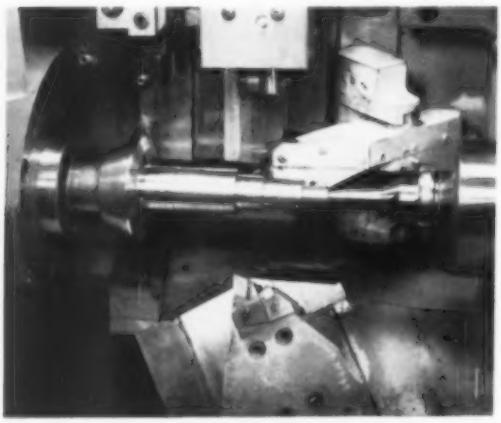
NEW BRITAIN MACHINE CO.

• By William Retz and Jacques Carpenter

WHEN the entire outside surface of the work must be machined on New Britain's "GF" copying lathe, the conventional type of chuck or work driver cannot be used. The workpiece is mounted between centers as usual, but the driving torque is transmitted from the spindle to the work by sharpened driving points called pin drivers on the spindle. These are embedded in the end of the work by a high force momentarily applied by the tailstock.

Fast traverse of the tailstock was needed to save production time. High force had to be exerted momentarily when the tailstock contacted the work. When the work was completely engaged in the headstock, force had to be reduced to hold the piece without overloading the spindle bearings.

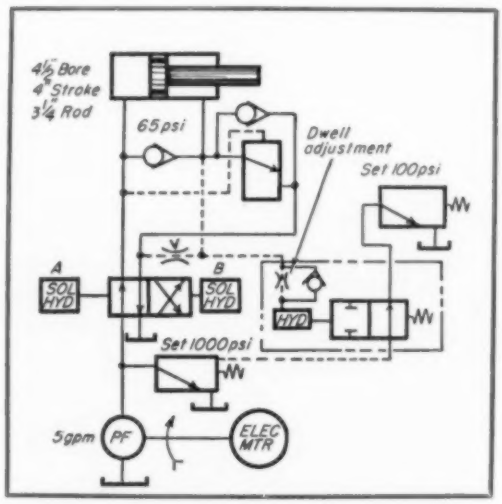
The system which was developed uses a differential circuit to get the fast traverse. A venting type relief valve set for high pressure is connected to a pilot relief valve set for low pressure to control the thrusting force and the holding force.



WORKPIECE IS HELD BETWEEN PINS on the headstock and tailstock for complete machining of the cylindrical surfaces. Copying slide moves at 60-degree angle with work axis.

SEPARATELY MOUNTED HYDRAULIC SYSTEM has been adapted to Swiss developed copying lathe. Hydraulic tracer system is built into the carriage.

• **Fast Traverse**—When solenoid *A* of the 4-way valve is energized, delivery of the 5-gpm pump is directed to the head end of the cylinder. Because the sequence valve is set higher than the pressure which is developed during traverse, it remains closed, and flow from the rod end of the cylinder is through the check valve forming a differential circuit. Since rod-end fluid joins with pump delivery, the cylinder and tailstock advance rapidly. The check valve is set at 65 psi so that this pressure is applied to hold open the 2-way, pilot-operated valve in the vent line of the main relief valve.



TAILSTOCK DRIVE SYSTEM is actuated by push-buttons which energize the solenoids. Speed and force are then pilot controlled.

• **High Force**—When the work contacts the headstock, pressure in the cylinder head-end line rises to push the work into the headstock projections. As soon as pressure rises to the setting of the sequence valve, the valve opens connecting the rod end of the cylinder directly to tank. This removes the back pressure, and permits the cylinder to exert its full thrust.

• **Low Force**—The drop in rod-end pressure also lets the 2-way valve shift to its spring-offset, open position. However the pilot choke in the 2-way valve is adjusted to delay shifting of the valve long enough so that the work is forced into the headstock at high pressure. When the valve has shifted, pressure on the cylinder is limited by the pilot relief valve which is set just high enough to hold the work without overloading the headstock bearings while the work is being machined.

The reduced pressure when the 2-way valve shifts allows the sequence valve to close. However the 2-way valve remains open because its pilot line is connected to tank through the needle valve and the 4-way valve. The needle valve prevents any pressure build-up in the pilot line to the 2-way valve because of leakage past the cylinder piston.

The check valve which develops pilot pressure on the *extend* stroke of the cylinder serves an additional purpose on the *retract* stroke. When the cylinder and tailstock are fully retracted, the check unloads the pump at 65 psi. This requires only about .3 hp from the 1½-hp motor. ▼▼▼

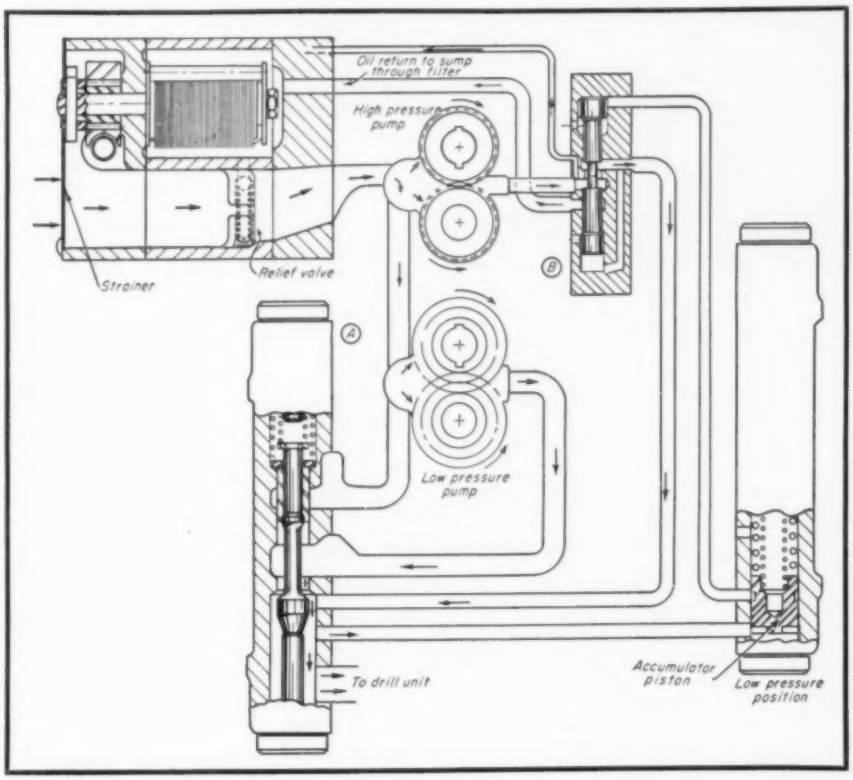
WILLIAM RETZ, *Chief Engineer, New Britain-Gridley Div., New Britain, Conn.* JAQUES CARPENTER, *Vickers, Inc., Worcester, Mass.*

Power pack for step drill

LELAND-GIFFORD CO.

• By Eric Hirvonen

STEP drilling of deep holes has the continuous cycle: rapid approach, adjustable drilling feed, and rapid withdrawal of the drill from the hole. Leland-Gifford uses this pump arrangement in their self-contained drill unit. Both pumps deliver at 30 psi during the 300-ipm rapid approach. A cam-actuated valve then starts the ½ to 40-ipm adjustable feed at 250 psi, and system pressure actuates valve *A*, unloading the low pressure pump. Rapid return is started by an electrical timer. The accumulator prevents surges during valve shifting. When it fills, it connects high pressure fluid to the top of valve *B*, unloading the high pressure pump. The high pressure pump pressure rise operates a turning mechanism to clean the oil filter. ▼▼▼

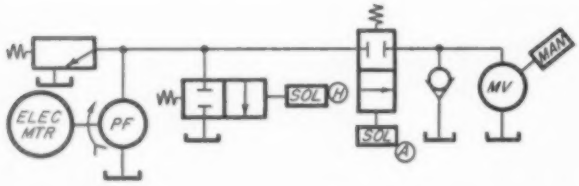


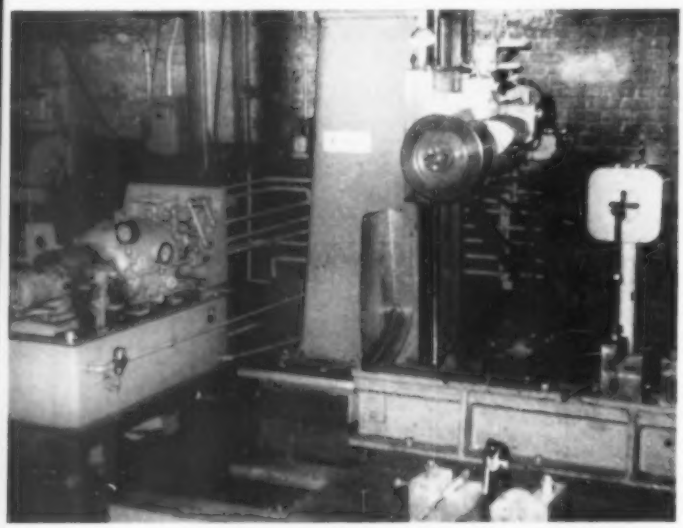
ERIC HIRVONEN, *Chief Engineer, Leland-Gifford Co., Worcester, Mass.*

Spindle drive for milling machine

DOMINION BRIDGE CO.

• By L. Braun

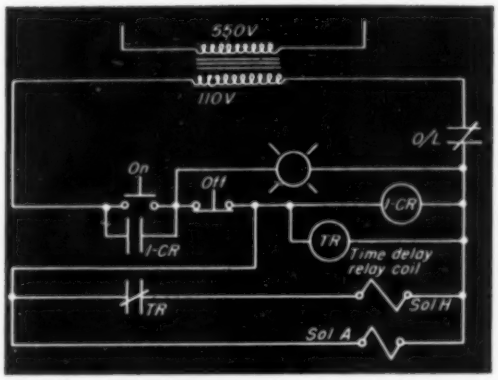




IN HYDRAULIC CIRCUIT above, unloading valve is deactuated after electric motor is started. This assures starting under no load.

ELECTRICAL CIRCUIT shows connection of time delay relay which keeps solenoid *H* energized. At end of timed period, timer contacts open.

MILLING MACHINE for structural sections has a constant displacement pump with a variable displacement motor. Torque requirement varies inversely with speed.



VARIABLE speed for a milling machine spindle, from 800 to 3000 rpm, with a nearly constant 20-hp output is gotten from a hydraulic transmission. The machine was specially developed to face light structural sections very speedily without elaborate holding devices for the section being machined..

A fixed-displacement pump supplies a variable-displacement motor. Motor speed control is manual. Since only one-way rotation is needed, the hydraulic control system is very simple. All there is to it is: Start the drive motor and the hydraulic motor runs. Manual speed adjustments can, of course be made while the hydraulic motor is running.

An interesting feature of the hydraulic and electrical circuits is the use of a time-delay relay to assure that the drive motor will always start without the load of the hydraulic motor. A normally-closed contact on the time delay relay opens a 2-position, 2-way valve to bypass pump flow to tank until the delay interval ends.

A 2-position, 2-way valve either blocks or sends flow to the hydraulic motor. Whenever the start button is pushed, solenoid *A* is energized to open the valve. Otherwise, the valve is spring closed. A check valve between motor inlet and tank lets the motor draw oil from the tank when oil is shut off and spindle inertia keeps the motor turning. This keeps the motor from running dry. ▼▼▼

L. BRAUN, *Technical Assistant to Works Manager, Dominion Bridge Co., Ltd., Lachine, Que., Canada*

Lathe hydraulics

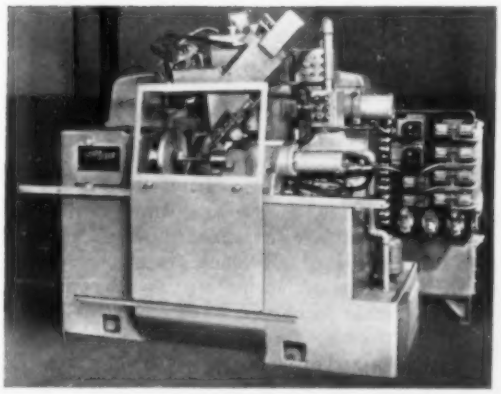
THE BULLARD CO.

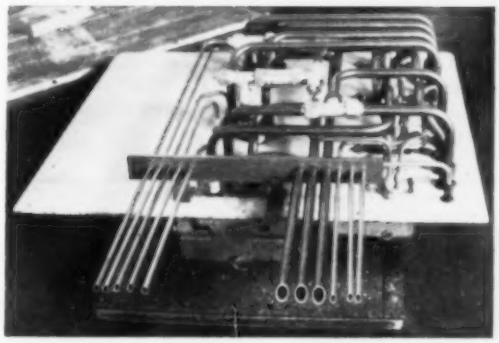
SEPARATE pumps are used to power the tool carriage and the tracer slide cylinder on the Bullard Hydra-Feed lathe to give fast, stable, and accurate response of the tracer. If the same pump were used to supply the tracer valve and cylinder as well as the tool carriage cylinder, changes in the carriage oil need could affect tracer operation.

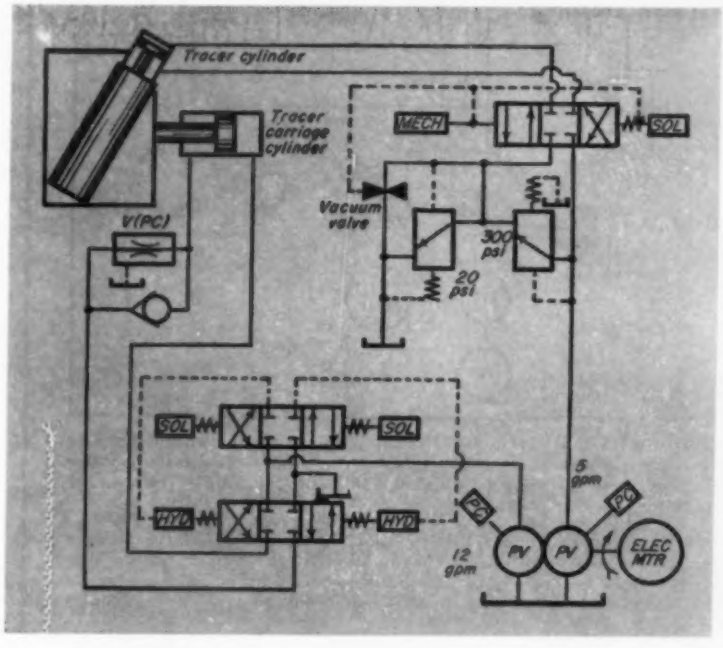
• **Elimination of pipe threads** in the power unit is another important feature of the hydraulic design of this machine. All lines are tubed. Valves are all panel mounted on sub plates. It costs more, but less leakage and easy valve removal more than makes up for it.

• **Tracer control** of tool feed lets pieces be turned to intricate shapes quickly and easily. Mechanical connection to the tracer valve is through a stylus that rides on a template with the same contour as that wanted on the finished workpiece. The valve is mounted on the tool slide so that displacement of the spool moves the slide to center the valve. The slide, therefore, follows stylus movement. Solenoid operator at one end of the valve lets the slide be retracted at any time, regardless of stylus position.

The vacuum valve and 20 psi relief valve damp the response of the tracer valve to prevent overshooting or hunting. Whether flow rates through the valve and cylinder are high or low, the relief valve maintains back pressure of 20 psi on the vacuum valve which is a venturi-like orifice. Flow through the vacuum valve creates a vacuum which is applied to the tracer valve to assure positive drainage of the chambers at the ends of the valve spool. This prevents oil in the chambers from interfering with valve action and reducing its sensitivity. ▼▼▼







MOVEMENT OF STYLUS riding on template actuates solenoid valve controlling machine slide on this tracer lathe.

VALVES MOUNT on subplate with inserts that seal against valves. This cuts down leakage. Inserts also serve as tube fittings.

VACUUM VALVE and 20-psi relief damp response of servo valve.

Pump meters small flow on a honing machine

BARNES DRILL CO.

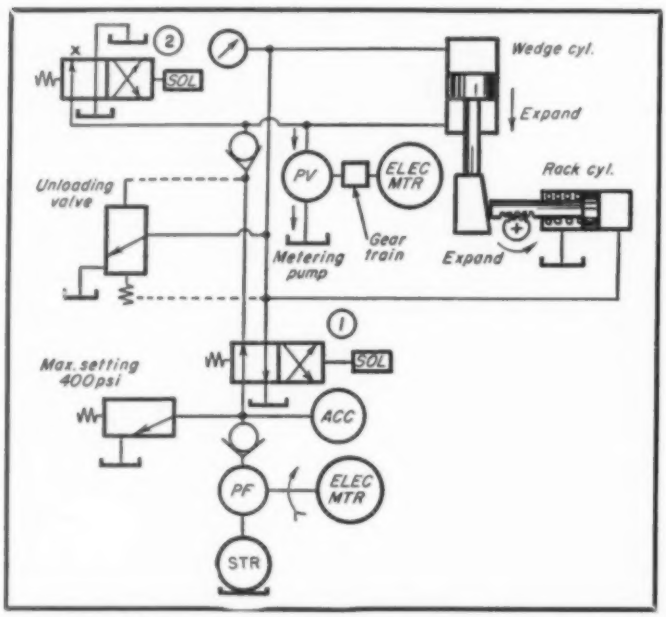
• By Frank Reynolds, Jr.

TO control flow rates of 1 to 2 cipm, Barnes Drill has developed a metering circuit using a special pump. The stones on the company's horizontal honing machine are expanded hydraulically at rates from .0005 to .010 inch per stroke of the hone. The commoner methods of speed control—variable volume pumps or metering valves—were out of the question for flow rates this small.

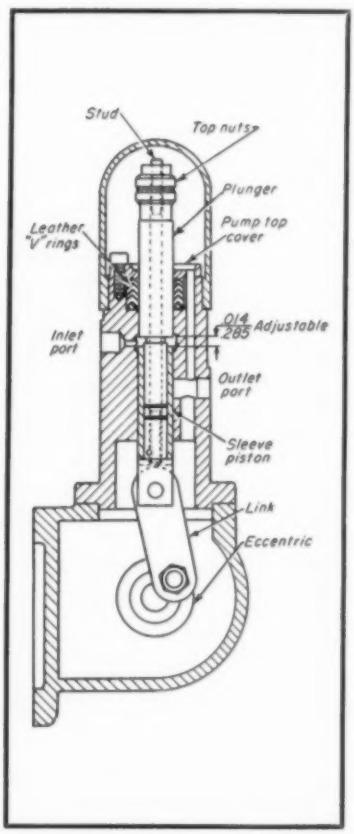
The stones are expanded by a shaft concentric with the main spindle shaft. This shaft is rotated through a rack and pinion by a spring-loaded, 2¼-inch cylinder. The cylinder bears against a wedge which in turn is moved by a second cylinder. Speed of the wedge and rate of stone expansion is controlled by metering the exhaust of the wedge cylinder through a pump.

• **Machine Set-up**—In setting up the machine, solenoid valve 1, shown on the circuit diagram, is actuated to direct fluid from the ¾-gpm gear pump to the head end of the wedge cylinder and to the head end of the rack cylinder. The rack cylinder extends to the wedge at a speed controlled by a flow control valve to give fast expansion of the stones. If the stones have not contacted the work (the operator can tell by a squealing noise characteristic of honing) he presses a pushbutton to actuate valve 2. This bypasses the metering pump and connects the rod end of the wedge cylinder to tank for fast expansion of the stones. As soon as honing begins, valve 2 is deactuated, so that exhaust from the wedge cylinder must then pass through the metering pump.

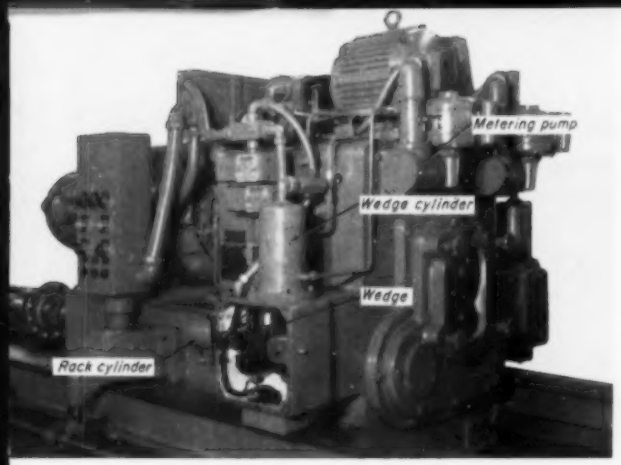
When the job has been completed, the stones have to be collapsed quickly to prevent honing the hole too large. Valve 1 is deactuated, and pump flow plus accumulator flow is directed to



SPRING-LOADED RACK CYLINDER is forced against the wedge and advances according to metered flow from the wedge cylinder. Unloading valve provides additional oil path for quick collapse of stones.



DISPLACEMENT OF METERING PUMP is adjusted by sliding plunger on central shaft which is pinned to link. At the top of the plunger stroke, fluid is forced into the annular space formed by the plunger and the sliding sleeve. This fluid is exhausted to tank at the bottom of the stroke.



DRIVE END OF 2-SPINDLE HONING MACHINE shows hydraulic components for controlling stone expansion. This is reciprocated on ways by a fluid motor-driven chain. The fluid motor is part of a separate hydraulic system.

retract the wedge cylinder. This in turn retracts the rack cylinder. Pump flow is also directed to open the unloading valve which is set at 50 psi. The unloading valve provides an additional path to tank and helps collapse the stones quickly. Since the valve is set at a very low pressure, the drain line from the spring compartment is piped into the system, so that pressure is applied with the spring to close the valve.

• **Metering Pump**—The metering pump has a single plunger with an adjustable annular space for carrying fluid from the pressurized inlet port to the outlet port which is connected to drain. The length of this space can be adjusted from .014 to .285 inch. Since the plunger is $\frac{3}{4}$ inch in diameter, the fluid volume can be varied from .0619 to .125 cu in. The pump is driven at 173 rpm through a gear train from an electric motor, so metered output varies from 1.07 to 2.16 cim. ▼▼▼

FRANK REYNOLDS, JR., *Hydraulic Engineer, Barnes Drill Co., Rockford, Ill.*

Safety circuit for transfer

EXPERT AUTOMATION MACHINE CO.

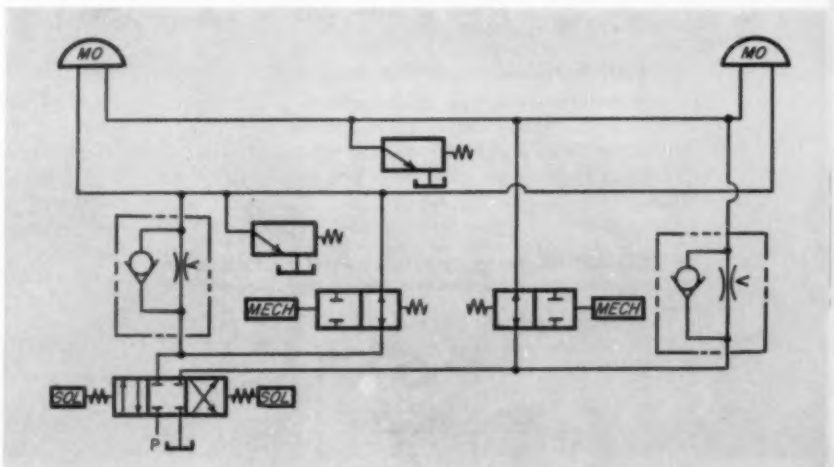
IF the load on a hydraulic actuator, due to its own weight or inertia, drives the actuator and makes it pump fluid, a special circuit design is often called for.

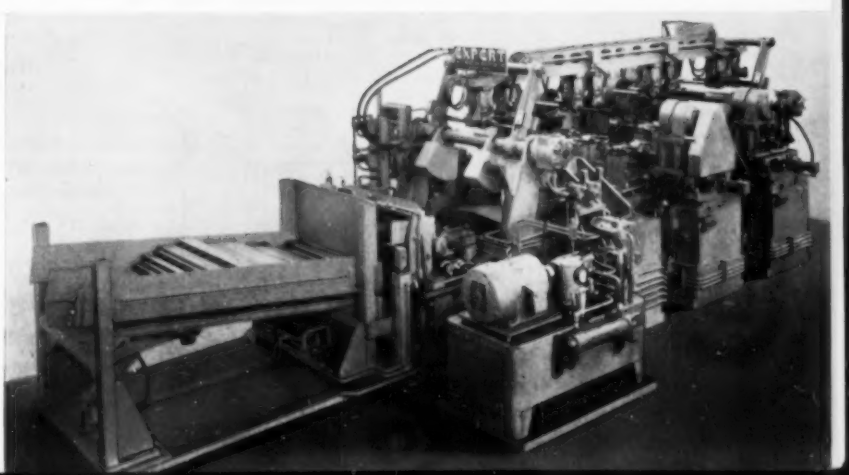
On a transfer machine built by Expert Automation to flare, face, chamfer, and bore both ends of tubular automotive steering columns, tubes are transferred in pairs by an overhead, oscillating transfer bar from one station to the next. As shown by the photo, this transfer mechanism is heavily counterweighted.

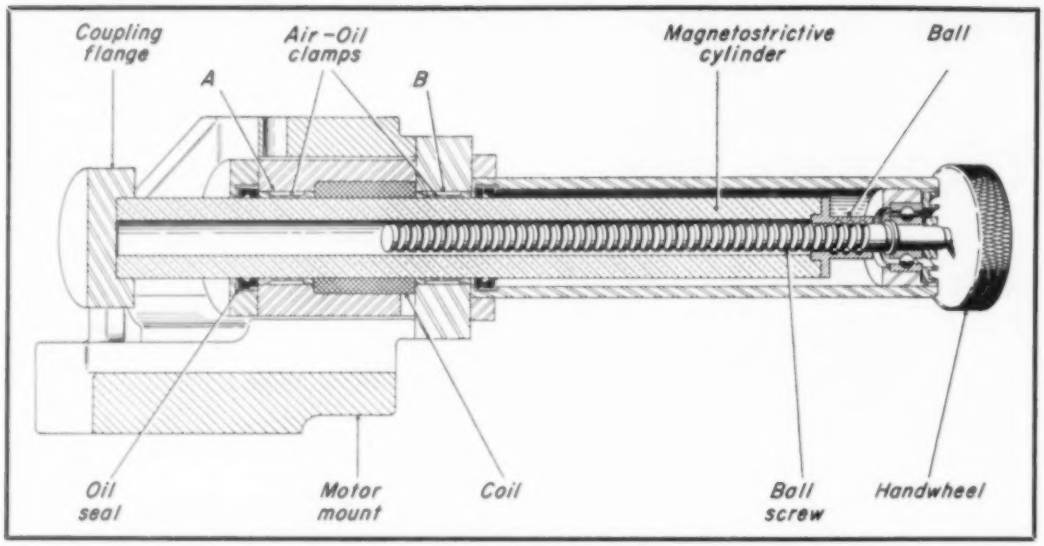
Tubes are fed to the transfer mechanism from a hopper by air-operated devices. An air-powered lifter plate picks the tubes up, one at a time and carries them up to an inclined feed magazine. The tubes then slide, two at a time into grooves in a shuttle plate. The air powered shuttle plate then moves the tubes forward to an air-driven elevator that carries the tubes to the first transfer station.

• **Circuit design**—Two rotary hydraulic actuators power the transfer mechanism. They are quite a distance from each other but are

Concluded on page 74







TO MOVE the magnetostrictive cylinder in respect to the clamps, open clamp A close clamp B, energize coil, then close clamp A, open clamp B and de-energize coil.

Air-oil clamps won't let inchworm squirm

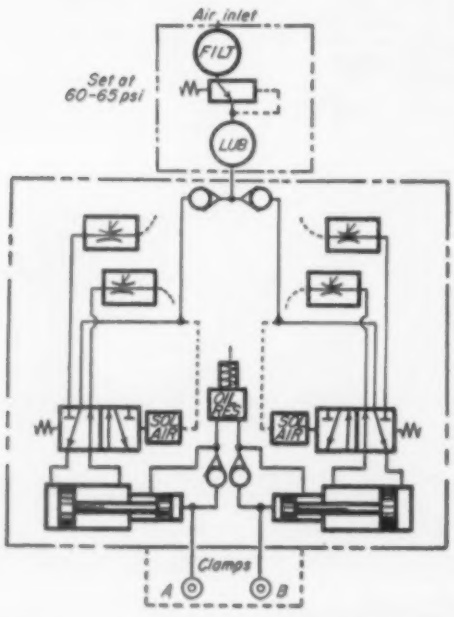
AIRBORNE INSTRUMENTS LAB.

• By Edward Silver

THE Inchworm motor uses the principle of magnetostriction which is the change in dimension of metal when placed in a magnetic field. It produces linear motion for moving machine tool slides in increments as small as a few millionths of an inch. The Inchworm steps along by contracting and expanding, clamping and unclamping like its familiar green namesake.

Air-oil boosters produce 2500-psi hydraulic pressure using 5-port, 4-way air valves to control the 65 psi input air pressure.

FIVE-PORT, 4-way air valves control air-to-oil boosters that actuate Inchworm motor hydraulic clamps.



• **How it works**—The air-oil circuit diagram shows the Inchworm motor in its normal position. With the solenoids de-energized and air supplied to the system, the clamps are locked. For incremental feed, current is applied to the solenoid valves and magnetostrictive coil in the required sequence by cam-operated switches mounted on a shaft that rotates one revolution for each step. The check valves in the air supply line prevent the clamps from releasing if the air pressure fails, thus giving a fail-safe feature to the unit. They also hold one clamp locked when air pressure drops due to the other clamp being released.

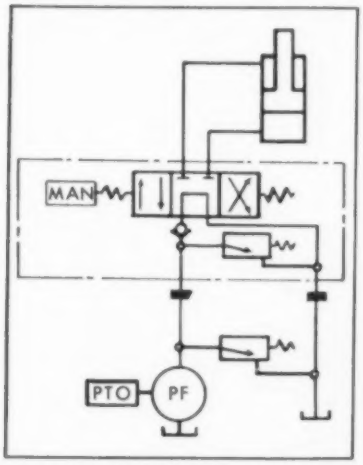
The check valves in the 2500-psi oil lines from the boosters prevent oil under pressure from returning to the reservoir.

An alternate system had been tried using a high pressure hydraulic supply and a 3-way valve for each clamp. It turned out to be simpler, more compact, and cheaper to use one booster for each clamp. ▼▼▼

EDWARD SILVER, *Mechanical Engineer, Applied Research Div., Airborne Instruments Laboratory, Mineola, N. Y.*

Fluid power gives low-boy important lift

COMPACT HYDRAULIC COMPONENTS and ease of piping them, even around corners, simplifies their mounting in protected places and leaves the deck of the gooseneck on the Hydrau-Lift clean and free of obstruction.



CIRCUIT DIAGRAM shows how COMMERCIAL fluid power components function in the simplified operation of the Rogers Hydrau-Lift Trailer.

HYDRAULIC CYLINDER lifts entire load. Spinning of tractor drive wheels in soft ground is no problem because no tractor effort is used to raise load.

COMPLETE CONTROL in raising or lowering gooseneck and front end of trailer is by simple one-hand operation of hydraulic control valve. Only minutes are required to ready trailer for loading or unloading because fluid power action is fast, positive and controllable. Hydraulic piping includes quick-acting, self-closing disconnect fittings between the tractor and the gooseneck.

COMMERCIAL foot-mounted hydraulic cylinder raises and lowers bed of Rogers Hydrau-Lift Trailer

The mounting of the double-acting cylinder is confined entirely below the deck of the detachable gooseneck because the construction of the COMMERCIAL cylinder has a very low ratio of stroke to overall closed height. Nothing protrudes above the flat and unobstructed deck—shovel dippers or bulldozer blades are carried without the risk of damage to the gooseneck or equipment.

How it works—Driven off the tractor power takeoff, a Model "D" constant delivery gear pump generates fluid power. A Model UBO7 four-way, three-position directional control valve directs this power under a normal working pressure of 1100 psi to move the cylinder.

Positive safety protection for the hydraulic system and equipment is assured because pressure relief valves are built into the circuit. At a predetermined setting, pressure build-up will release at 1750 psi and pump discharge will by pass through the relief valve and dump directly into the oil reservoir. Thus, if shock loading or a restriction in the circuit develops, no damage to the hydraulic components or equipment will result. All this protection is automatic—achieved without need for warning signals or action by the operator.

Hydraulic advantages—Finger tip control of the Model UBO7 control valve is handled right at the side of the gooseneck where the operator sees all movements. Remote control from the cab of the tractor and frequent "observation" trips back to the trailer give way to time-saving, complete on-the-spot operation. Only with hydraulic operation is loading and unloading of the outfit as fast—often in less than three minutes. Fare weight savings aid in meeting local load restrictions. For instance, elimination of cable winch saves 1000 pounds. Lower cost equipment, simplified construction and reduced maintenance result from the use of fluid power on the Hydrau-Lift trailer by Rogers Brothers Corporation.

Your product, too, may benefit from the use of fluid power. COMMERCIAL'S combination of experience and proven, heavy-duty fluid power components may provide you with the way to save weight, simplify design, lower production cost and improve product performance.

Why don't you send your problem to: Commercial Shearing & Stamping Company, Dept. A-27, Youngstown 1, Ohio?

COMMERCIAL shearing & stamping

CIRCLE 25 ON TIME-SAVER CARD

Ideas FOR MACHINE TOOLS

Hydraulics makes tapping automatic

NATIONAL ACME CO.

• By Harry Brown

BOTH ends of a pipe coupling are threaded automatically on a vertical tapping machine. The operator only loads and unloads the pieces. All machine motions are hydraulically powered except the tap during the actual threading operation.

• **Operation**—The coupling is the correct length and inside diameter for tapping when placed in the machine. It is first clamped; then the tapping head feeds down to tap one end. The head then retracts. When the head is fully retracted, the coupling is turned over and the other end tapped.

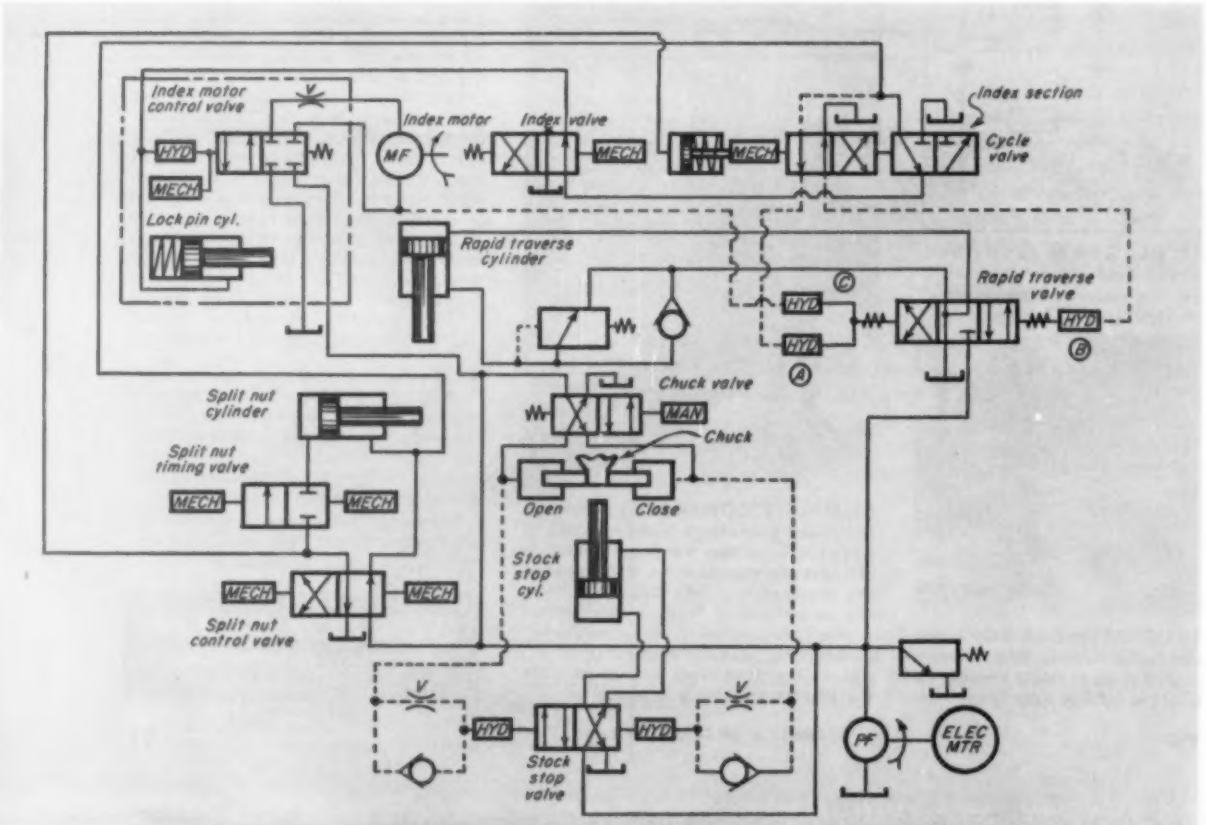
• **Chucking**—A diagram of the complete hydraulic circuit, is shown below. The chuck is opened to load the coupling by shifting the *Chuck* valve to apply pressure to the single-acting *Open* cylinder and connect a similar *Close* cylinder to tank. This also applies pressure to the left end of the *Stock Stop* valve to move a stop into place so that the piece will be placed at the proper depth in the chuck jaws. Needle valves control the shifting speed of the *Stock stop* valve to be sure that the stock stop does not interfere with unloading and also that the stock stop remains in position until the chuck jaws are tightly closed. Releasing the *Chuck* valve handle closes the chuck jaws on the loaded piece and moves the stock stop out of the way.

• **Tapping** is started by moving a lever connected to a dog and ratchet which turns the rotary *Cycle* valve to the position shown on the diagram. The *Cycle* valve has a 4-way and a 3-way section. Internal construction is such that the 3-way section shifts every other time that the 4-way section shifts.

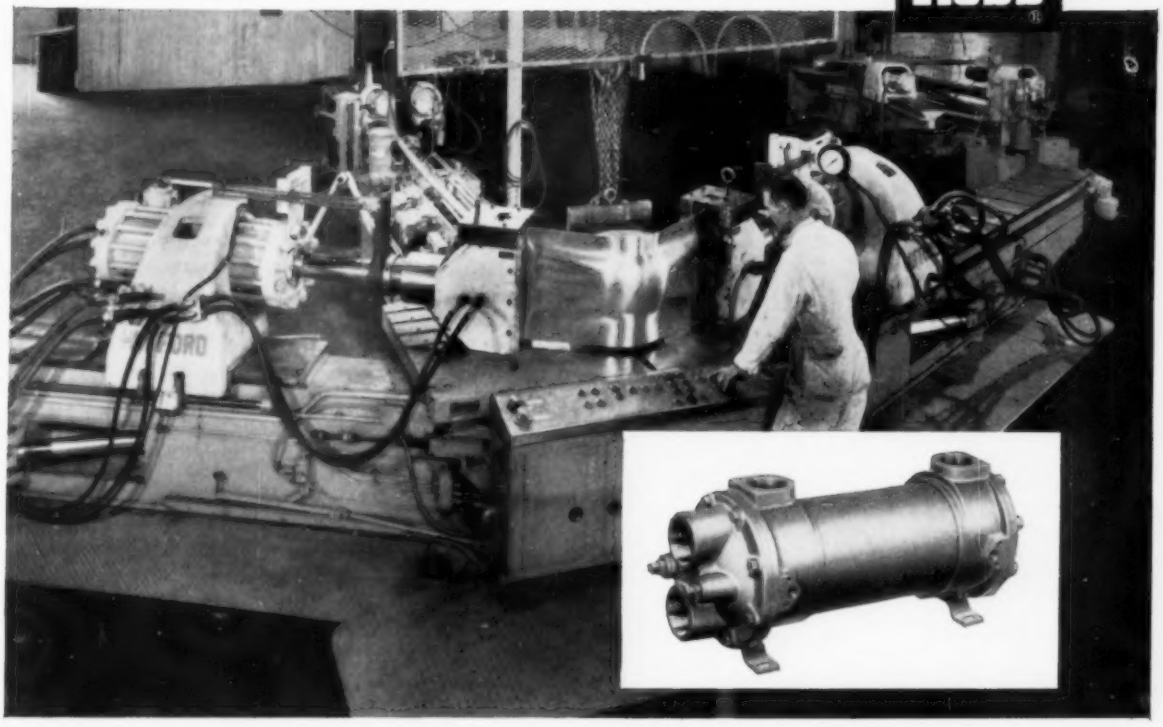
With the *Cycle* valve in this position, pressure is applied to piston *A* of the *Rapid traverse* valve. The *Rapid traverse* cylinder then moves the head down toward the work at about 330 ipm. As the head nears the work, the *Split nut control* valve is shifted by a latch to apply pressure to the *Split nut timing* valve and the single-acting cylinder which moves the *Cycle* valve operating lever to shift the *Cycle* valve. The *Index* valve does not shift at this time.

Shifting the *Cycle* valve relieves pressure at

HYDRAULIC CIRCUIT DIAGRAM of the vertical tapping machine.



HYDRAULIC FLUID COOLING BY ROSS



Radar reflectors pulled into shape with 118,000 pound stretch

Shaping aluminum radar reflectors, this Hufford Hydraulic Stretch-Wrap Forming Machine exerts up to 118,000 pounds of pull with its powerful jaws. With the metal drawn to its yield point and wrapped around a stationary die, curvature is compounded in two directions without wrinkles.

To maintain consistent hydraulic pressures by preventing pump slippage from overheated, thinned oil, a Ross Type BCF Exchanger was installed as original equipment. Even under highest pressure, hydraulic temperature remains within desired limits. *Efficient cooling is assured.*

Says Hufford Machine Works, Inc., "Ross Exchangers are compact, easy to install and perform satisfactorily . . . We have been using them for years."

First in ruggedness and high thermal efficiency, Ross Exchangers are regularly furnished with practically every type and make of hydraulic machinery: die casters, metal drawing presses, extrusion presses, gear shapers, powdered metal presses and fluid drives.

Recently redesigned, Ross Type BCF Exchangers feature *new* flanged-lip baffles for tighter tube fit and improved thermal characteristics, *new* movable feet for easy installation, *new* materials, *new* sizes and capacities in one, two or four pass designs.

For detailed information on these pre-engineered, fully standardized units, use coupon below to request new Bulletin 1.1K6.

TO:

American-Standard — AH 7
Ross Heat Exchanger Division
Buffalo 5, N. Y.

Please send, without obligation, your new Bulletin 1.1K6 describing the redesigned Ross Type BCF Heat Exchanger.

NAME _____

TITLE _____

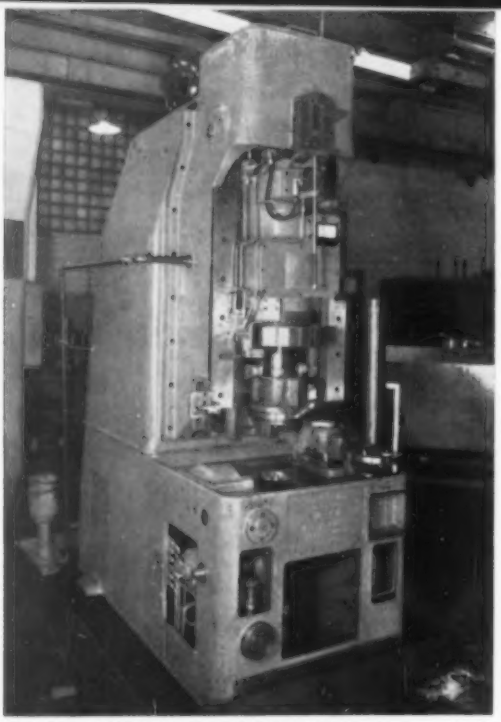
COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

*American-Standard and Standard ® are trademarks of American Radiator & Standard Sanitary Corporation.

AMERICAN-Standard
ROSS HEAT EXCHANGER DIVISION



MANY HYDRAULIC CIRCUIT ideas are used in this automatic vertical tapping machine.

piston *A* of the Rapid traverse valve but does not apply pressure to piston *C* because the shift of the *Split nut control* valve removed pressure from the inlet of the *Cycle* valve. Thus, the *Rapid traverse* valve shifts to the center position and the cylinder stops.

The *Split nut timing* valve is a rotary valve driven by a worm wheel and the tapping lead screw. This setup assures that the *Split nut* cylinder cannot move to engage the split nuts in the tapping head with the lead screw when the crests of the split nut threads and the lead screw threads would touch each other. Crest to root engagement is assured because fluid passages in the timing valve line up at that time. With the nut and leadscrew engaged, the timing valve is held open and the tapping head is driven downward by the lead screw. Lead screw and tap are driven all the time by a tapping electric motor.

When the thread is tapped, a link from the collapsing tap shifts the *Split nut control* valve to retract the *Split nut cylinder* and apply pressure to the cycle valve. Pressure is then applied to piston *B* of the *Rapid traverse* valve, the valve shifts, and the *Rapid traverse* cylinder moves the tapping head upward.

• **Indexing**—The *Index* valve is operated by a dog when the tapping head reaches its upper limit. This applies pressure to the *Lock pin* cylinder and the pilot connection of the *Index motor control* valve. The lock pin is withdrawn from the chuck and the *Index motor control* valve starts the *Index* motor. Applying pressure to the *Index* motor also applies pressure to piston *C* of the *Rapid traverse* valve. Pressure applied to piston *C* insures that the *Rapid traverse* valve will stay positioned to hold the *Rapid traverse* cylinder and tapping head up as long as the index motor is running, no matter what else happens.

When the fluid motor has revolved the chuck 90 deg, rotation of the chuck operates the *Cycle control* valve to shift it and apply pressure to piston *B* of the *Rapid traverse* valve. The valve does not shift, however, because pressure is applied to piston *C*. The *Index* section of the *Cycle* valve also shifts at this time. This removes pressure from the *Lock pin* cylinder and the *Index motor control* valve, but the pin is held out and the valve is held open mechanically by a cam surface on the chuck until the locking notch is reached. Then the pin goes into the notch and the valve closes to stop the *Index* motor. The cam surface closes the valve at a controlled rate to control motor deceleration and give a smooth stop.

Closing the *Index motor control* valve removes pressure from piston *C* of the *Rapid traverse* valve. Since pressure was applied to piston *B* halfway through index, the valve shifts and the *Rapid traverse* cylinder moves downward to repeat the tapping process. ▼▼▼

HARRY BROWN, *Experimental Engineer, National Acme Co., Cleveland, Ohio.*

SAFETY CIRCUIT FOR TRANSFER

Concluded from page 69

mechanically connected by the transfer mechanism itself.

Since the transfer mechanism weighs about 800 lb, deceleration must be controlled to stop impact at the end of travel. Flow control valves and cam-operated, 2-position, 2-way valves do this. As the end of travel is neared, the 2-way valves are operated by the mechanism to block flow and force the fluid to go through the flow control valves. There is a 2-way valve and a flow control for each travel direction. Fluid is metered out of the actuators because inertia of the load would cause it to overrun the fluid supply if fluid were metered in.

Relief valves are put in the actuator lines as safety devices. In case of electrical failure, the control valve would be spring centered. Since it is a closed-center valve, fluid on the exhaust side of the actuators, which would be pressurized by the inertia of the load, would have no place to go and might break a hydraulic line. The relief valves are set above normal working pressure and will open to prevent damage if the control valve is centered accidentally. ▼▼▼

PRE-PACKED HYDRAULIC POWER

. . . the modern method of hydraulic installation

No more inefficient and unsightly long pipe runs when you use a Keelavite power pack. Just couple the pack to the actuators and the complete system is ready for operation.

Packs are assembled from standard units of equipment to meet specific power and control requirements.

Keelavite

POWER PACKS

THE RECOGNISED AUTHORITY ON HYDRAULIC POWER TRANSMISSION

KEELAVITE ROTARY PUMPS & MOTORS LTD., ALLESLEY · COVENTRY ENGLAND
Tel.: MERIDEN 441 Grams: KEELAVITE · COVENTRY

CIRCLE 66 ON TIME-SAVER CARD

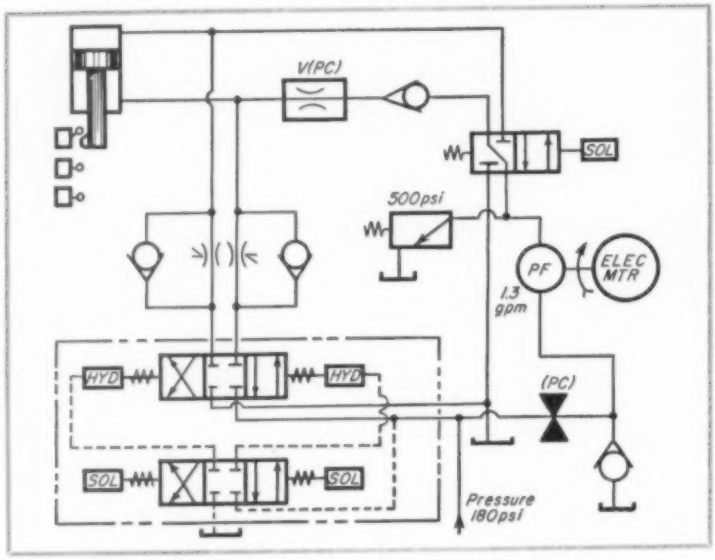
Boring tool feed

MERZ ENGINEERING CO.

• **Feed requirements**—A very slow, uniform feed—about 0.004 in./rev at 3100 rpm—was needed to impart an rms 50 finish during boring; therefore, a separate pump is installed to supply the boring feed cylinder. Most important reason for doing this was to prevent uneven feed caused by fluctuating system demands on a big transfer machine.

• **Feed circuit**—A 1.3 gpm vane pump operating at 500 psi supplies fluid for the feed portion of the boring cycle. Rapid advance and return are powered by an 18.5 gpm pump operated at 180 psi. The large pump also supplies fluid to many other stations on the machine.

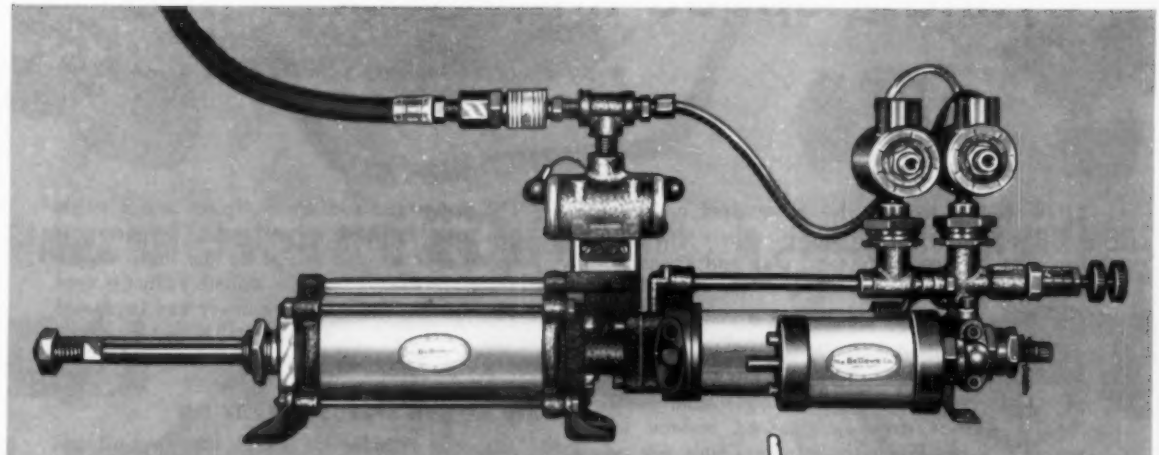
Sequencing of rapid advance, feed, and return is done with limit switches and solenoid valves. Speeds for rapid advance and return are controlled by needle valves metering out. A pressure-compensated flow control is used for the feed speed control. During rapid advance and return, the 500 psi from the small pump seats a check valve in series with the flow control so the small pump will not affect the function of those circuits.



• **Flow control valve** connected from the 180 psi pressure line to the small pump inlet is set to meter a slightly larger amount of oil than the small pump needs. The slight excess passes off to tank through the check valve teed into the suction line. This setup is used because the small pump is at the work station and a very long suction line would be needed to reach the tank at the main hydraulic power unit. Flow control and check also reduce pressure to the pump inlet so the pump cannot run as a hydraulic motor with resulting erratic output. ▼▼▼

FEED PUMP is mounted at the work station. Its inlet is supplied by oil from the 180 psi pressure source fed through a flow control.

HOW TO "INCH" AN AIR CYLINDER



With this packaged Bellows Air Motor-Hydro-Check Air Cylinder power unit you can do these things:

YOU CAN STOP THE PISTON ROD TRAVEL AT ANY POINT, OR AT AS MANY POINTS AS YOU WISH

YOU CAN "INCH" IT ALONG JUST AS WITH AN ELECTRIC DRIVE

YOU CAN CHANGE THE SPEED OF THE PISTON ROD TRAVEL FROM FAST TO SLOW AND BACK

You can set it up for single cycle control or synchronize it with related elements for repeat cycling with precision accuracy. This Bellows Air Motor-Hydro-Check unit is available in standard stroke lengths up to 18″ and in five bore sizes: 1¼″, 1¾″, 2½″, 3⅝″, and 4½″.

Not all pneumatic applications require the range of control provided in this Bellows unit, of course. But, regardless of the type of control you require, you can obtain it in Bellows Air Motors, and usually in the form of one compact, complete, packaged unit — simple to install — doubly simple to control.

THESE BULLETINS CONTAIN THE STORY

Bulletins BM-25 and HC-602 give full details on Bellows Air Motors and Hydro-Checks and the Bellows System of Air Control. There's no charge. Write Dept. AH-758, The Bellows Co., Akron 9, Ohio. In Canada, Bellows Pneumatic Devices of Canada, Ltd., Toronto 18, Ontario.

The Bellows Co.

DIVISION INTERNATIONAL BASIC ECONOMY CORPORATION

AKRON 9, OHIO

1125-B

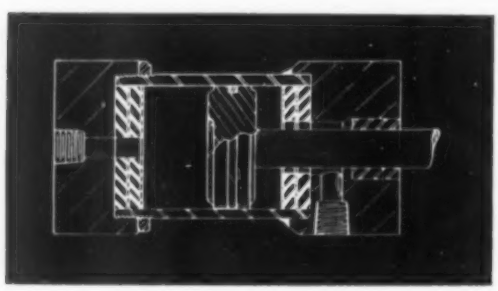
Cylinder speed and shock

• By Elmer F. Heiser, *S. G. Morris Co., Cleveland, Ohio.*

HOW fast is too fast for a standard cylinder? The speed of piston movement is not a problem. The trouble starts (and may end simultaneously) when the piston stops at the end of the stroke.

• **Design Considerations**—Cylinders for high speed service should receive attention on several points. If cycle time permits deceleration before the end of the stroke a standard cushion will probably work. When the time available for cylinder stroke cannot accept reasonable deceleration, it's necessary to start thinking beyond standard cylinders, since repeated shock will result in fatigue failure.

Any points of stress concentration at threads, necks, shoulders, and slots should be reduced to a minimum. This is especially important at the piston rod and piston assembly. In some cases it is necessary to make the piston and rod of one piece with a polished radius at the corners to reduce localized stresses.



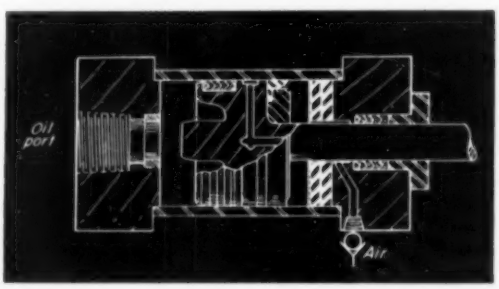
A standard piston is usually made up of separate sections, held together with screws or a nut at the piston rod. All such assemblies which can shake loose must be locked with wire or tack brazed. The heads and their mounts should be beefed-up to absorb the shock.

Sketch 1 shows an air cylinder that was successful on a job where standard cylinders failed. The application required a 2 in. bore, single-acting cylinder with a 2½ in. stroke, operating continuously at 150 cycles per min. The cylinder had to complete its stroke in ¼ of the cycle time, so it operated at a speed equal to 600 strokes per min. Standard cylinders failed in from a few minutes to a few days.

The piston and rod are one piece and a single piston ring is used for a seal. The piston is polished over all, and except for the sharp wiping edges at the cylinder wall, a smooth radius is used at all corners. The heads are heavy and laminated bumpers are used to avoid metal to metal impact.

AIR RETURN SPEEDS OPERATION

A special cylinder for a high speed cut-off machine is shown in sketch 2. Its stroke is less than



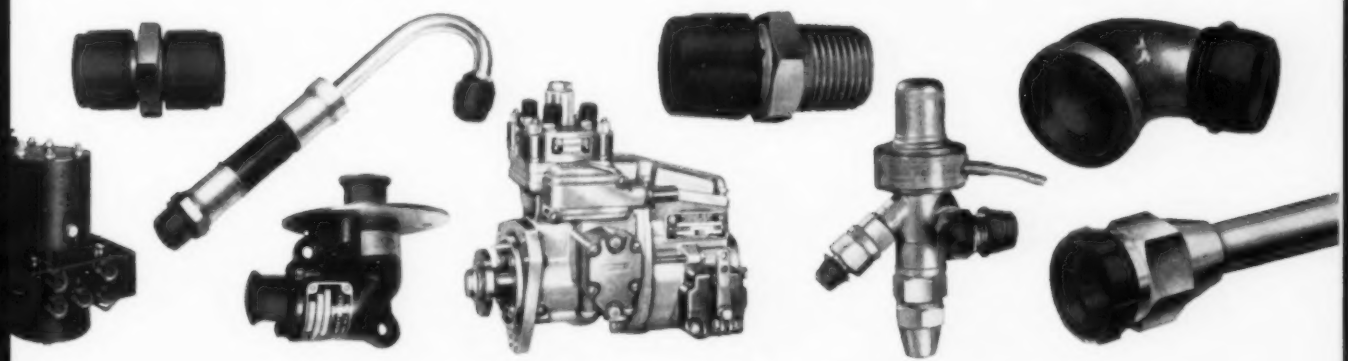
one inch. Oil at 1750 psi from an accumulator is admitted through an oversize port in the blank end. The rod end is precharged with 100 psi air. During the work stroke, the air is compressed against a check valve to 600 psi. The actual work of cutting required 1200 psi, and is completed in the initial ⅝ in. of cylinder travel. After the work of cutting is completed, overtravel allows time for the hydraulic valve to shift, connecting the cylinder blank end to drain. During this overtravel the air in the rod end is compressed which rapidly accelerates the piston return. A laminated bumper is built into the rod end head to absorb shock. A short cushion on the blank end reduces shock on the return stroke. Cylinder exerts a total cutting force of 9 ton and completes its cycle in .15 sec.

A hole through the piston rod connects into a drain well between the air and oil seals on the piston. Any leakage of air or oil past the packing is carried away through the piston rod at atmospheric pressure. ▼▼▼

This article is prepared from a chapter in Elmer F. Heiser's book Air and Oil Cylinders in Industrial Applications, published by APPLIED HYDRAULICS *magazine.*

CIRCLE 97 ⟶

Caplugs protect nearly everything under the sun...in process, storage and transit...



prevent damage to threads and delicate parts...keep out dirt and moisture...

made of tough, flexible polyethylene...won't chip, break, shred or collapse

Caplugs

10 standardized styles... over 500 sizes in stock

get a free handful
of Caplugs in exchange
for the attached coupon

CAPLUGS DIVISION, Protective Closures Co., Inc.
2203 Elmwood Avenue, Buffalo 23, N. Y.

MAIL a free assortment of Caplugs, literature and prices to us, without obligation.

NAME _____

TITLE _____

FIRM _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Circuit design for a large lathe

BALDWIN-LIMA-HAMILTON CORP.

• Z.C. Van Schwartz

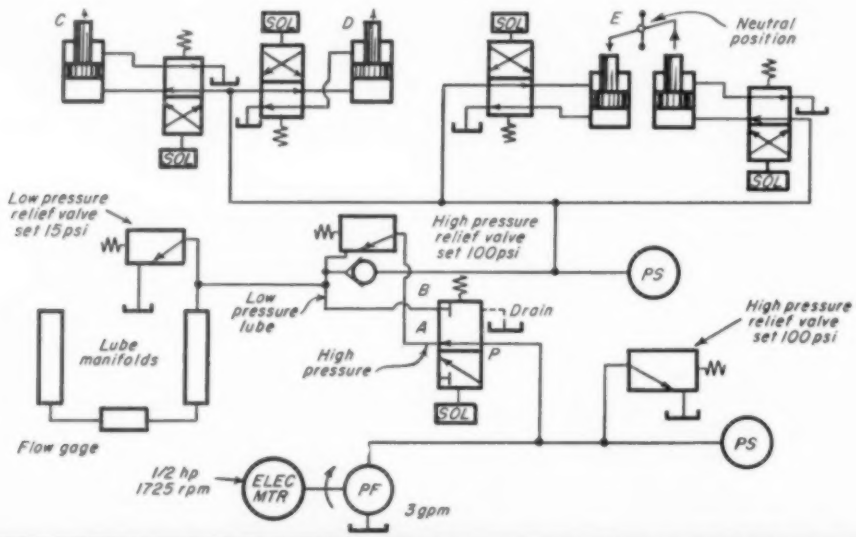
THREE separate hydraulic systems operating at less than 200 psi, are used on Niles heavy engine lathes (72-94 inch swing) designed by Niles Tool Works. All lathes regardless of size perform essentially the same operations and include the same basic parts: The headstock, spindle, carriage and tailstock; all mounted on a bed.

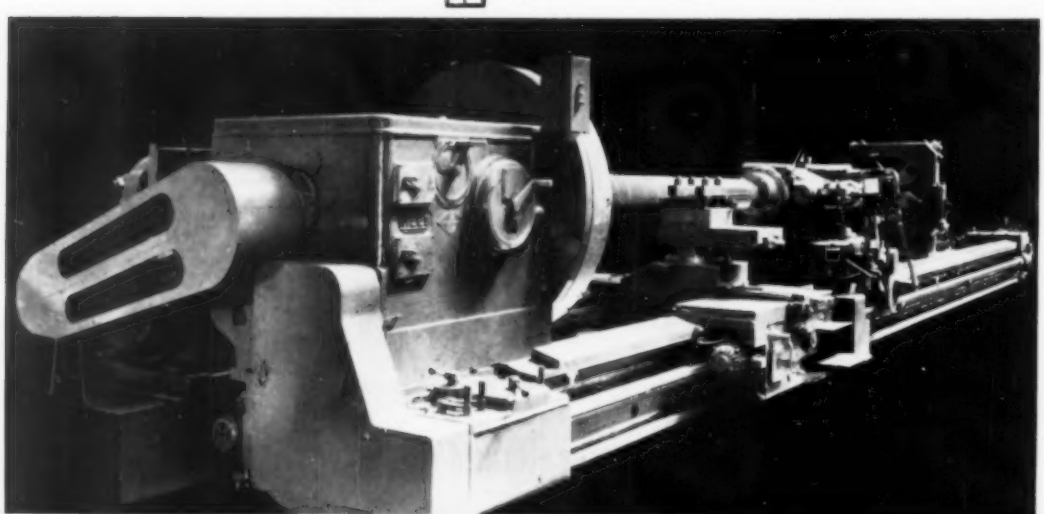
As the size of a lathe goes up, giving the operator a hydraulic assist becomes necessary to speed up operation and reduce operator fatigue.

SPEED CHANGE

This lathe has two separate drive ranges: one for the faceplate, the other for the spindle. To reduce operator effort when shifting between faceplate and spindle drive, a circuit using a rotary torque actuator was developed.

When the operator moves the speed change lever, a limit switch is contacted to shift the solenoid operated venting valve allowing the relief valve to close and pressure to build up for operation of the rotary actuator. Movement of the speed change lever also shifts a cam operated 4-way valve which gives directional control of the actuator. The gear pump which supplies oil to this circuit also supplies lubrication to the headstock gears. When the relief valve is vented, oil for lubrication flows through the filter to points of lubrication. A pressure switch on the downstream side of the filter senses lubricating pressure and starts and stops the pump drive as required.





CARRIAGE FEED

Nine operations of the carriage are obtained by hydraulically shifted clutches. A .150 gpm gear pump supplies three pairs of clutch cylinders and apron lubrication. A small bladder type accumulator eliminates pressure surges which would be harmful to the fine feed operations and acts as the fluid supply for the cylinders. Selector switches manipulated by the operator actuate solenoid valves to position the clutch cylinders. Two 1"x2" parallel cylinders are used at each clutch. One piston is moved to shift from neutral to feed. The other is actuated when traverse motion is needed. An illuminated signal board alerts the operator to feed direction. With the solenoid valves deenergized all clutches are in neutral.

TOOL FEED

By combining electronic control with hydraulic power there is no interruption during feed changes because there are no levers to change and no need to stop feed while changing from one into another.

All the solenoid valves operate clutch-shifting cylinders. The operator turns a feed directional selector to actuate the valves. The power pistons, with attached yokes, shift the clutches. Feed speed through electronic feed motor operation is infinite within any of the given ranges. The feed dial may be set within the scope of calibration at any point, either on the fine or coarse calibration, dependent upon the setting of the selector switch.

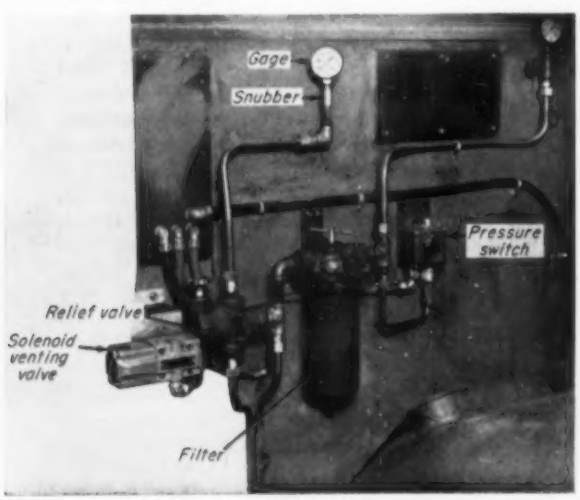
The electronic circuit is equipped with a "fail-safe" control. There are nine control relays and one pneumatic timing relay in the control cabinet for positive control of the solenoid valves. ▼▼▼

Z. C. VAN SCHWARTZ, *Director of Engineering Standards Baldwin-Lima-Hamilton Corp., Hamilton, Ohio.*

CLUTCH OPERATING circuit for the cross-slide feeds.

LARGE 72 in. lathe has three separate hydraulic circuits for spindle speed change, tool and carriage feed.

PRESSURE CONTROL valving and lube system for headstock change gears.



New Products By

L and L

Only L & L offers the complete line of fittings, with the widest choice of design, for any type of hydraulic piping application.

CN Fittings

- L & L "CN" seals pressure *without* use of O-Ring.
- Savings in tools, scrap and loss of production, also in assembly and maintenance.
- Eliminates stress in valves—elbows and tees can be positioned to 405°.
- Assemble and reassemble without damage to port or fitting—no need for sealing compounds.
- Excellent resistance to vibration.

L & L O-Ring Fitting

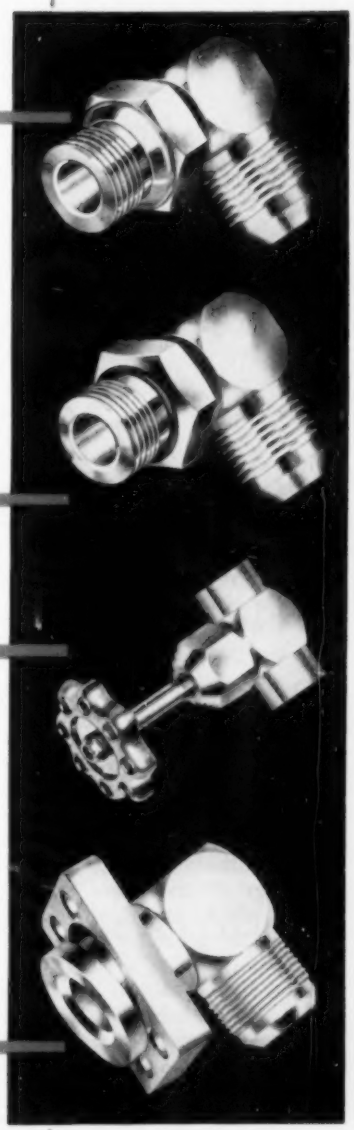
- Seals pressure *with* O-Ring.
- Reduces installation time—no need for sealing compounds.
- Range of sizes from ⅛" to 2".

Metering Valves
Carbon and Stainless Steel

- Pressures up to 5000 PSI.
- Straight or angle valves with male pipe, female pipe or tube connections.
- Use as a metering or shut-off valve.
- Range of sizes from ⅛" to ¾".

Flange Fittings

- S.A.E. bolt hole spacing.
- Solid and swivel tube, pipe or weld connections.
- O-Ring seal.
- Elbows and tees can be positioned.
- Bolt together and use as flange unions.



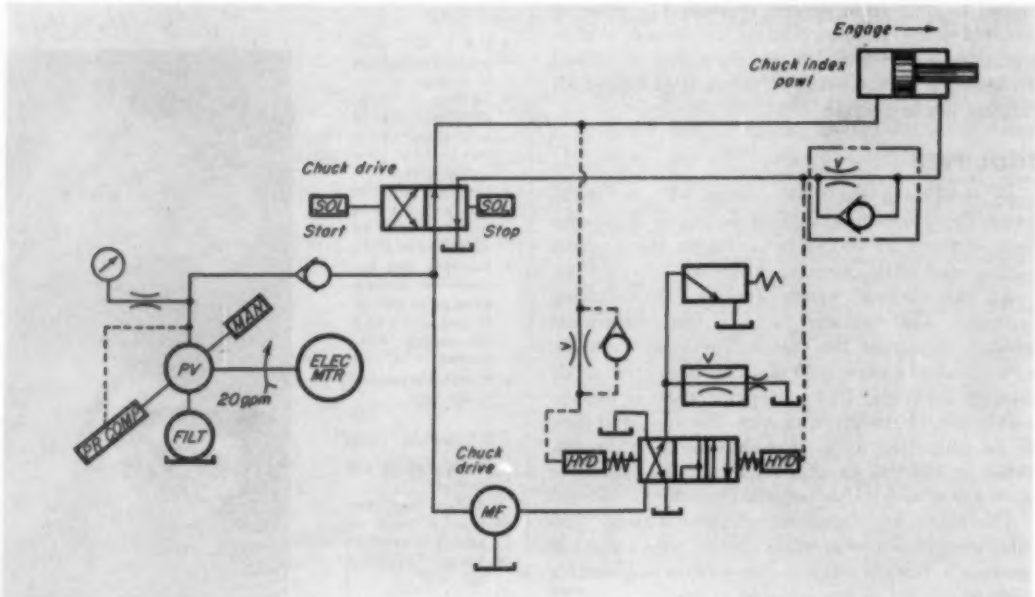
Representatives in principal cities. Write for full particulars to:

L and L MANUFACTURING COMPANY
8088 E. Nine Mile Rd., Van Dyke, Mich.

Only L & L gives you a "Complete Fitting Line"

CIRCLE 69 ON TIME-SAVER CARD

Brake control for drive motor



FLOW CONTROL valves are set to synchronize slowing down of the fluid motor which drives the chucks and extension of the cylinder which stops them in a fixed position. With chucks stopped during transfer, pressure-compensated pump shifts to near neutral position for a savings in horsepower.

IN a 9-station grinding machine for automobile torque converter housings, the work is transferred in nests on the transfer mechanism. These nests raise and lower to give clearance during transfer. At the three stations in which one face of the work is ground, the castings are transferred onto rest pads which contact the surface previously ground.

Since definite locating points must be maintained throughout the entire machining cycle, the work spindles which are driven by fluid motors must come to the same registered stopping position after completion of the grinding operation. The locating or pick-up nests on the transfer bars always contact the casting in the same position.

• **Chuck Drive**—The chucks are driven by fluid motors which permit simple speed control of the work rotating under the grinding wheel. To start the chucks, the START solenoid of the CHUCK DRIVE valve is energized. This connects fluid from the pressure-compensated pump to retract the CHUCK INDEX PAWL cylinder. This also actuates the 3-position valve to connect the fluid motor outlet to tank, so that the motor begins to rotate. A flow control valve meters pilot fluid from the valve to control its shifting speed and the motor acceleration.

At the end of the cycle, the STOP solenoid is energized. This shifts the 2-position valve and in turn the 3-position valve. Fluid from the motor is then connected through the fixed and variable flow control valves in series to slow down the motor. The CHUCK INDEX PAWL cylinder extends at a controlled speed, so that it stops the chuck in a fixed position after the chuck has slowed down. ▼▼▼

More than 150 circuits for machine tool design are included in the 1958/59 FLUID POWER DIRECTORY. For complete information about this 796 page handbook, write APPLIED HYDRAULICS, 812 Huron Rd., Cleveland 15, Ohio.

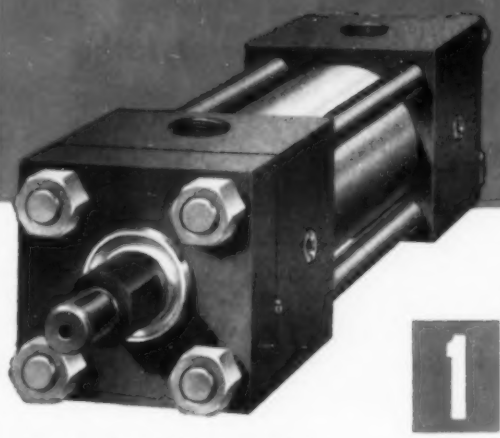
CIRCLE 79 ⟶

SEAL FAILURE MEANS CYLINDER FAILURE

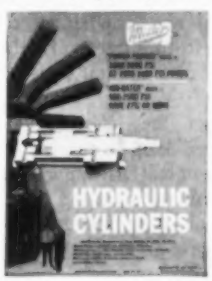
Petroleum base, fire-resistant and special hydraulic fluids cause distortion and rapid deterioration of the seals currently used in many hydraulic cylinders, resulting in costly repairs and cylinder failure. (Seals made of synthetic rubber are not compatible with even 50% of available commercial petroleum base fluids and the life of such seals is materially reduced at operating temperatures above 150° F.)

Specify Miller HYDRAULIC CYLINDERS

FOR UNLIMITED SEAL LIFE!



Request Bulletin JH-104N for complete data plus helpful charts on column strength, cylinder forces, factors of safety, acceleration, pipe pressure losses, etc.



1 ALL TEFLON* SEALED Against External Leakage

TEFLON is impervious to all known hydraulic fluids, including all fire-resistant and special types – and withstands temperatures from −100°F. to plus 450°F.

TEFLON SHEF SEAL AT TUBING ENDS

No blind assembly. Is

Shear-proof
Heat-proof
Extrusion-proof
Fluid-proof

TEFLON SEALS ON PISTON ROD AND BUSHING

Teflon rod flange seal requires no adjustment. Teflon bushing seal is shearproof. Teflon wiper keeps dirt out.

TEFLON SEALS ON BALL CHECK AND ADJUSTING SCREW

Non-protruding, self-locking, cushion adjusting screw interchangeable with ball check for easy access.

2 CASE-HARDENED CHROME PLATED PISTON RODS

Provide foolproof protection against seal failures resulting from rod damage. The Miller case-hardened rods (50-54 Rockwell C) give practically complete immunity to damage from hammer blows, wrench-dropping, mishandling, etc. The hard chrome plating over the case-hardened rods protects against scratch-damage and rust.

AVAILABLE IN TWO TOP QUALITY LINES

JOB-RATED
Model "J"

PRICE SAVINGS OF 27% OR MORE!

19 mounting styles, all strokes, cushioned and non-cushioned. Large selection for immediate shipment.

BORE	SEVERE OPERATING CONDITIONS	MODERATE OPERATING CONDITIONS	YOU SAVE THIS % IN PRICE OVER STANDARD 2000-3000 PSI CYLINDERS
1½"	1500 PSI	2500 PSI	27%
2	1500	2500	27%
2½	1000	1500	28%
3¼	1500	2500	32%
4	1000	1500	35%
5	800	1200	37%
6	800	1200	43%
8	500	800	50%
10	500	800	71%
12	500	800	76%
14	500	800	Not Available in 2000-3000 PSI

POWER-PACKED
Model "H"

50% More Power Per Cylinder Dollar!

For

3,000-5,000 P.S.I.

1½" through 12" bores, 17 mounting styles, strokes up to 22 ft., cushioned and non-cushioned. Large selection for immediate delivery.

*DuPont trademark for its tetrafluoroethyline resin

OTHER MILLER QUALITY FEATURES

- Solid Steel Heads, Caps and Mountings.
- Precision-Honed Barrels.
- Rust-Resistant Coating on All Non-Wearing Surfaces.
- Space-Saving "Square" Design.

MILLER FLUID POWER
DIVISION OF FLICK-REEDY CORPORATION

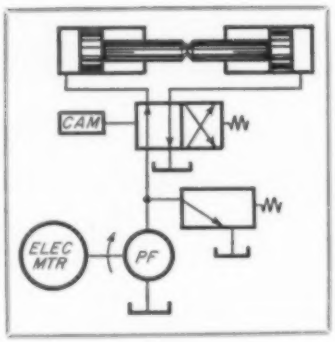
2008 N. Hawthorne Ave., Melrose Park, Illinois

AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

Clutch operation . . .

NATIONAL ACME CO.

• By Karl Schubert



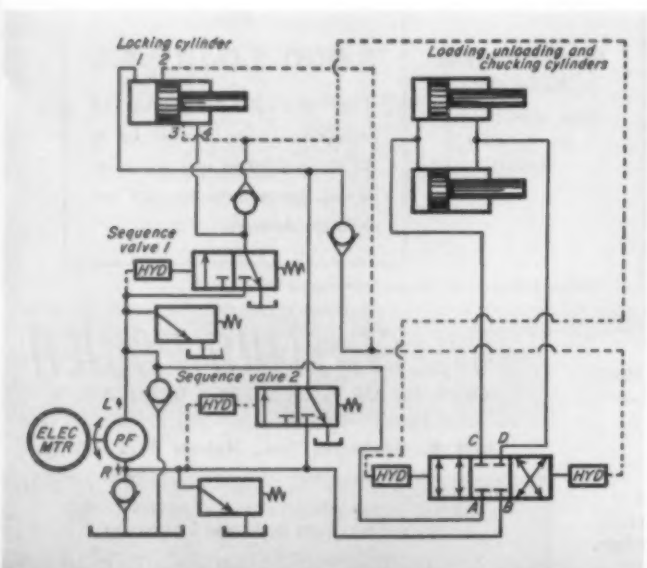
. . . on a turret lathe

SPINDLE speed changes automatically when the turret indexes by means of a cam-operated valve and hydraulic cylinders on a turret lathe for machining breech blocks. The hydraulic circuit, shown (left) is simple. The valve, operated by a cam driven off the turret, moves the cylinders in one direction or the other. When the cylinders are at either end, a clutch is engaged to select one or the other of two speeds.

. . . chucking circuits

HYDRALUICS are used to load, unload, and chuck the workpiece. The entire sequence is completely automatic and is started by push-buttons. A reversible motor and pump are used. Rotation in one direction causes the machine to load and chuck; in the other direction it unchucks and unloads.

With the workpiece on a loading cradle, the load and chuck cycle starts when the motor is started to pump oil in the *L* direction. Oil goes to port *A* of the control valve and out port *D* to the rod sides of the loading, unloading, and chucking cylinders. Rods are anchored to the chucking drum and pins operated by the locking cylinder lock the L-U-C cylinders to the cradle. The L-U-C cylinder bodies, therefore, move to the right and pull cradle and workpiece into the chucking drum. Return oil from the cylinders goes through valve ports *B* and *D* to the inlet side of the pump.



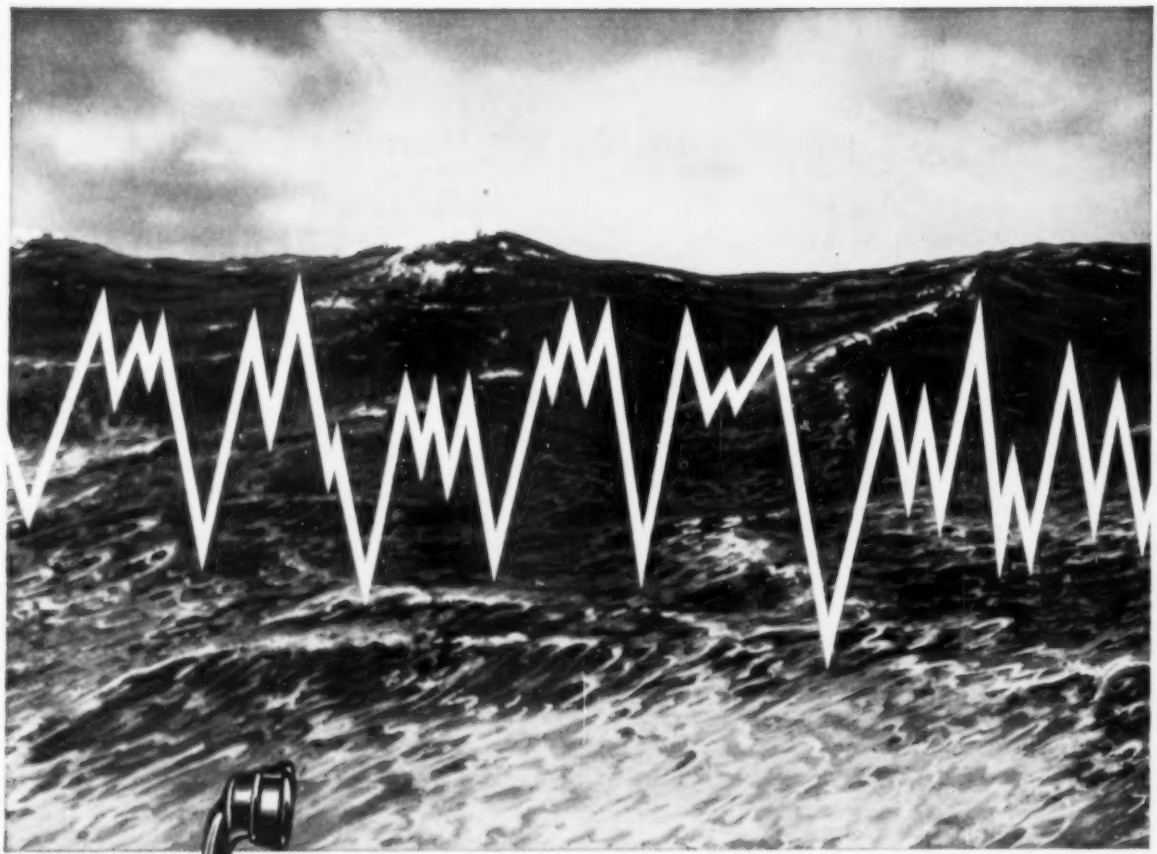
When the cradle bottoms, pressure builds up and operates sequence valve 1. It shifts to apply pressure to port 4 of the locking cylinder. As the locking cylinder piston moves to the left, it locks the cradle in position by gears and pins. When the locking piston has moved far enough to uncover port 3 of the cylinder, oil flows to the left end of the control valve and shifts it to direct oil through ports *B* and *C* of this valve to the left ends of the L-U-C cylinders.

At the same time that the locking cylinder locked the cradle to the chucking drum, the L-U-C cylinder bodies were unpinned. Oil applied to the left ends of the cylinders thus causes the bodies to move to the left. Chuck wedges attached to the bodies clamp the workpiece as the bodies move.

• **Unchuck-unload**—Starting the pump drive motor with rotation to pump oil in the *R* direction starts the unchuck-unload cycle. Oil under pressure goes to port *B* of the control valve and out port *D* to the right ends of the L-U-C cylinders. Cylinder bodies then move to the right to unclamp the workpiece. When the bodies reach mechanical stops, pressure increases and operates sequence valve 2. Oil then flows to port 1 of the locking cylinder, and moves the piston to the right to unpin the cradle from the chucking drum. When the piston has bottomed at the right end of the cylinder, oil passes out port 2 to the right end of the control valve and shifts it. Pressure is then applied to the left ends of the L-U-C cylinders through ports *B* and *C* of the control valve.

Because the cylinder bodies were pinned to the cradle when the cradle was unpinned from the chucking drum, the cylinder bodies now move to the left and move cradle out of chucking drum. ▼▼▼

KARL SCHUBERT, *National Acme Co., Cleveland, Ohio*



Telecommunications

Two recent major steps in the improvement of world telecommunications have been the laying of the first Trans-Atlantic and the California—Hawaii submarine telephone cables.

When laying cable either on a flat sea bed or over underwater mountain ranges, the exact control of paying out speed and tension in the cable is of paramount importance. On the cableship *Ocean Layer* (Submarine Cables Ltd.), the cable-laying equipment for which was supplied by Johnson & Phillips Ltd., 'VSG' variable delivery oil hydraulic pumps are used to act as brakes on the cable, which is drawn out of the ship by its own weight. This enables a very smooth and regulated control to be maintained or instantly varied to suit ship speed, paying out speed and tension in the cable.

It is just another of the highly varied applications of 'VSG' variable delivery pumps and transmission gears which have now been serving modern industry for fifty years.

'VSG'

SERVING MODERN INDUSTRY 1908-1958

VICKERS ARMSTRONGS (ENGINEERS) LTD VICKERS HOUSE BROADWAY LONDON SW1

Positioning pistons on an air transfer machine

HOLE ENGINEERING SERVICE

• By Harry Satterthwaite

WITH the trend to transfer type machines, especially for high production automotive work, Hole Engineering Service has designed a pneumatic machine for finishing holes in pistons.

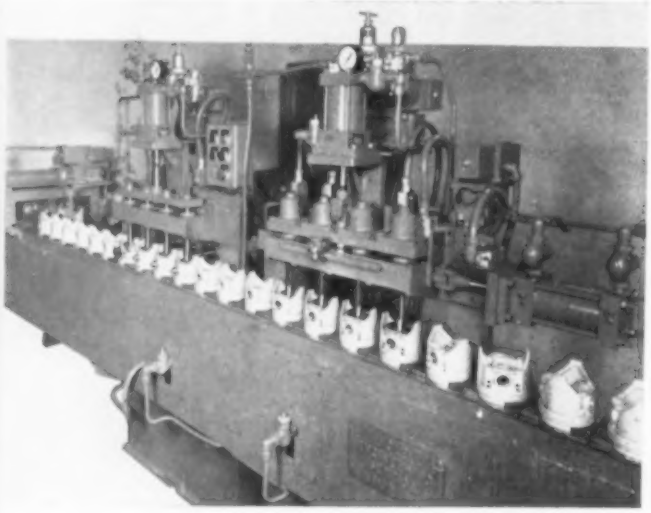
The machine sizes and finishes the piston pin holes in an operation called bearing-izing. This peens the holes to make an accurate size and hard finish. Of the six cylinders on the machine, only one is for actual tool feed. The others advance the conveyor, align the work, insert a tool holder, and unload the finished work. Sequencing is by limit switches.

The pistons are loaded into the conveyor, and the machine operates continuously. As the pistons advance under the locator head, four at a time, four locators find their way into the pistons, regardless of the positions of the pistons on the conveyor. When the locators are down they are rotated together to align the pistons, so that the piston pin holes are perpendicular to the conveyor. The locators are then retracted.

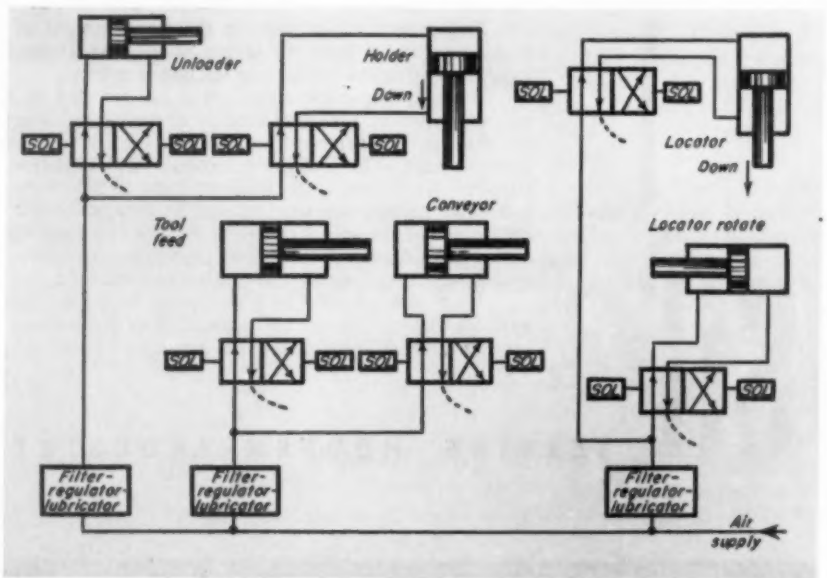
At the tool station, the HOLDER cylinder advances four tool holders into the pistons, and the TOOL FEED cylinder advances the tools which are supported in the pistons by the holders. An electric motor rotates the tools.

When the bearing-izing operation is done, the tools and holders retract, and the CONVEYOR cylinder moves the four finished pistons to the unloading station. This also advances four pistons to the aligning station and the work station. The UNLOADER cylinder operates a rail unit which unloads the four finished pistons onto another conveyor which transfers them to the next manufacturing process. The complete cycle takes 8 seconds. ▼▼▼

HARRY SATTERTHWAITE, *Manager, Hole Engineering Service, Detroit, Mich.*



THREE STATIONS on this pneumatic transfer machine align the automobile pistons, bearing-ize them, and unload onto another conveyor.



DOUBLE SOLENOID, 2-position valves controlling the cylinders are energized through limit switches which sense cylinder positions.

STRONGER and SAFER for every high pressure pipeline duty...

...because they are drop forged by Vogt

Constantly imitated but never duplicated, Vogt drop forged steel fittings and flanges have unmatched strength and toughness for your most severe pipeline duties. Laboratory controlled materials and Vogt's special forging techniques assure products which are always uniform in structure, fine grained, and free from porosity. Thereby the shocks and stresses imposed by high pressures and high temperatures are easily withstood, and with stubborn resistance to erosion and corrosion. Consult Catalog F-9 for our complete line of fittings and flanges.

For a copy of Vogt Catalog F-9 address Dept. 24A-FAH.

HENRY VOGT MACHINE CO., P.O. BOX 1918, LOUISVILLE 1, KENTUCKY

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Philadelphia, St. Louis, Charleston, W. Va., Cincinnati, San Francisco

OTHER VOGT PRODUCTS

Drop Forged Steel Valves — Petroleum Refinery and Chemical Plant Equipment — Steam Generators — Heat Exchangers — Ice Making and Refrigerating Equipment.

Vogt

DROP FORGED STEEL

Fittings and Flanges

Ideas FOR MACHINE TOOLS

Planer changed to profile cutter

NATIONAL SUPPLY CO.

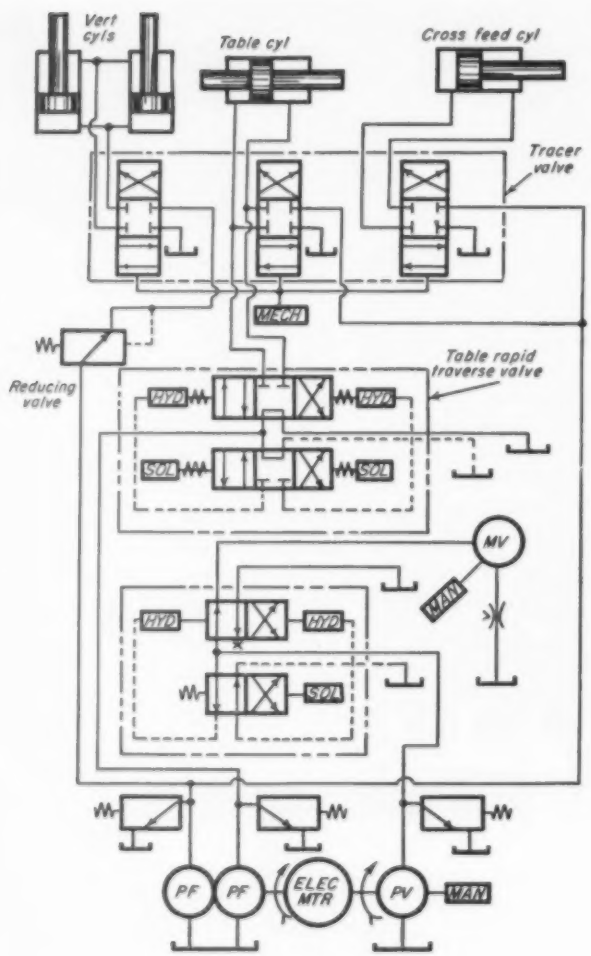
AN open-side planer was converted into this three-dimensional, tracer controlled milling machine. A 20-gpm variable delivery pump powering a 20-gpm variable delivery hydraulic motor was selected for the drive.

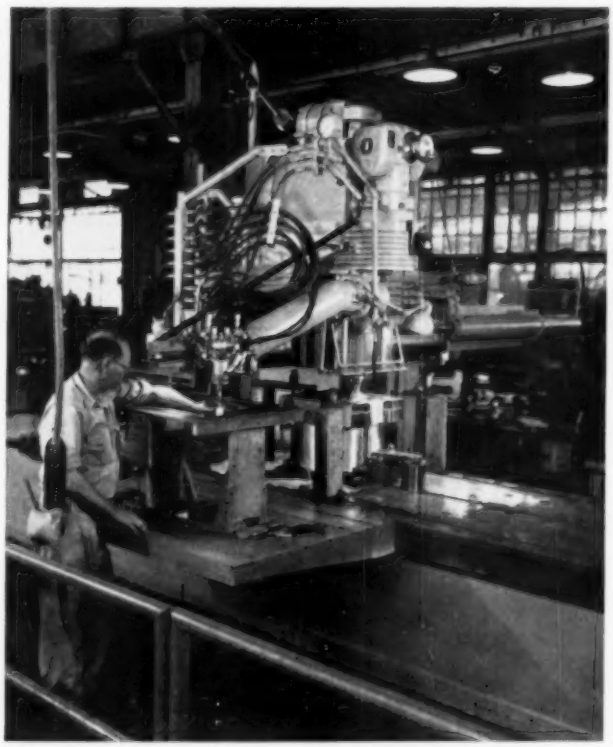
• **Transmission characteristics**—Spindle speeds run from 60 to 3000 rpm at any desired relation between torque and hp. Displacement of pump and motor are set manually. The drive makes the machine practical for high-speed small diameter face milling, and slow-speed milling with large cutters.

This sort of fluid drive has many advantages. One is its ability to stall under load without damage, and another its smoothness which eliminates shock and vibration.

• **Tracer system**—The heart of the tracer head is a hydraulic servo valve, which mechanically uses the movement of a stylus to position its spools and to control oil flow to tool cylinders. The three spools are at right angles to one another and each is parallel to the tool cylinder it controls. Valve flow is regulated by the setting of a rate cam, giving uniform feed rate regardless of styles deflection.

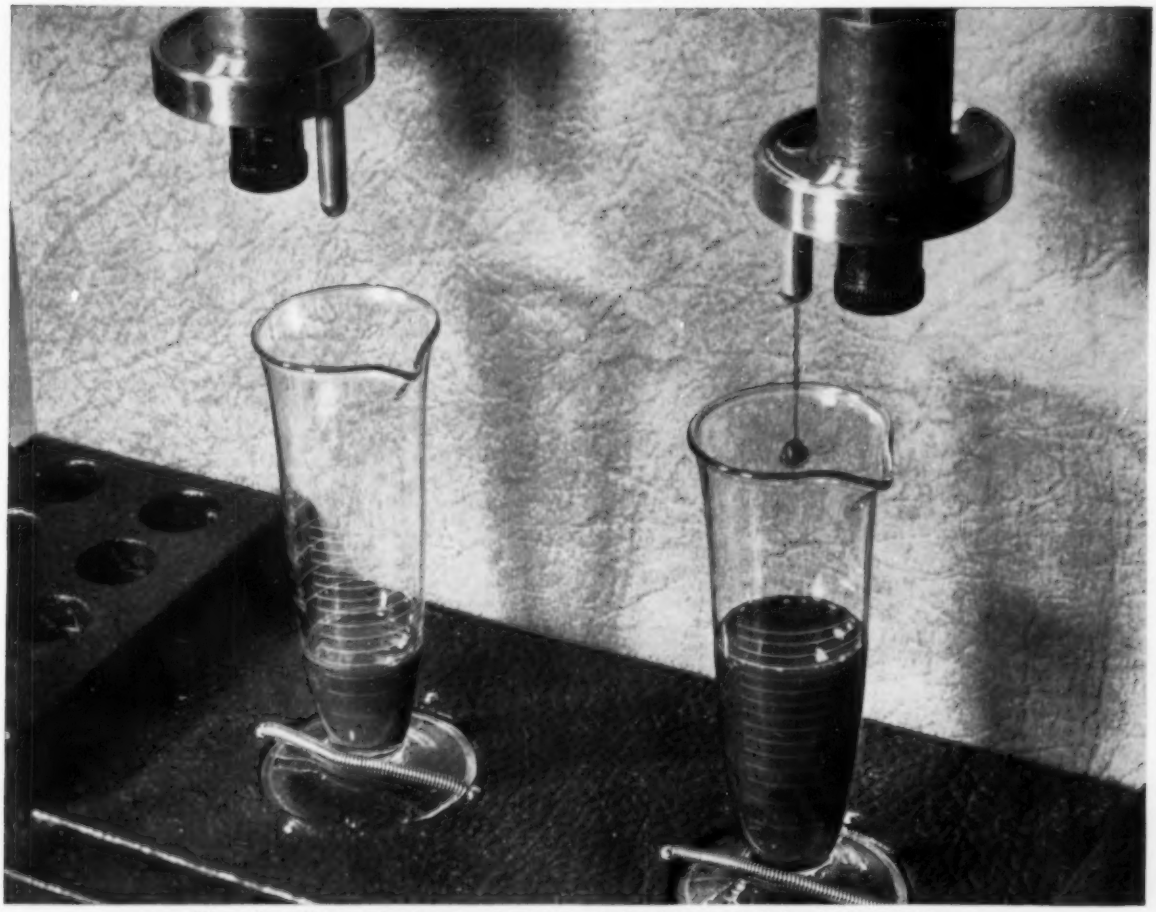
Hydraulic power for machine movements is provided by a dual pump of 11-gpm capacity for table rapid traverse and 11 gpm for 3-dimensional feed movements. Cross and vertical rapid traverse are made by opening the tracer valve for maximum feed. An overhung pendant controls spindle start-stop and table rapid traverse. The table cylinder has a double rod extension. Rods are anchored at both ends and the cylinder moves with the table. Vertical travel of the milling head is 8 in., provided by two cylinders on opposite sides of the spindle housing. ▼▼▼





ALL MOTIONS on this milling machine are oil powered.

A VARIABLE DISPLACEMENT spindle drive gives a wide speed, torque and power range.



The oils collecting in these graduates are being forced, at 100 psi, through two sintered bronze bearings. Although each oil has the same viscosity, the Suntac on the left is leaking *only one quarter as much as* the straight oil on the right.

Desk-top demonstration proves that SUNTAC HYDRAULIC OILS can cut your oil losses . . . up to 75%

Suntac® oils are competitive in price, competitive in quality, *and unique in their ability to reduce oil leakage without costly shutdowns.*

Suntac oils are high-quality, exceptionally stable mineral oils especially compounded to reduce leakage. Experience proves that they give longer pump and seal life with higher overall operating efficiency.

See for yourself how a Suntac oil can cut your oil costs. A simple desk-top demonstration will show you how.

Ask your Sun man to show you how others have reduced oil consumption, or write to Dept. AH-7.

Industrial Products Department

SUN OIL COMPANY, Phila. 3, Pa.

SUNOCO

© 1958 SUN OIL COMPANY

In Canada: Sun Oil Company Limited, Toronto and Montreal

Leakproof
Metal-To-Metal Straight Thread
FLODAR Port Fittings

- Save Space — No swing radius needed.
- Easy Installation — Coins its own seat.
- Metal-To-Metal Seal — No "O"-rings required.

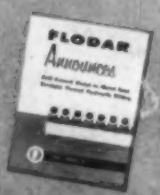
■ This new FLODAR port fitting cuts installation time and cost when making hydraulic connections at pumps, valves, manifolds, cylinders and similar installations. It consists of a stem and body with a floating nut which turns freely on the stem. Tightening the nut forces the stem into its seat at the bottom of the porthole forming a tight, leak-proof, metal-to-metal seat.

It's easy to install, too! No grinding, honing or other special seat preparation is needed. An ordinary step-drill or counter-bore forms the seat — the fitting coins its own seal.

Permits Ganging of Fittings

Unique construction of the FLODAR port connection provides a major space-saving advantage for multiple connections. For example, two ½" fittings may be located on less than 1" centers without interference. Because the floating nut turns while the body remains stationary, no swing radius is required and the connection can be broken without disturbing hydraulic lines.

***Send for Flodar Catalog M-57** . . . contains complete information on sizes, types, construction and installation of these new FLODAR port fittings.*



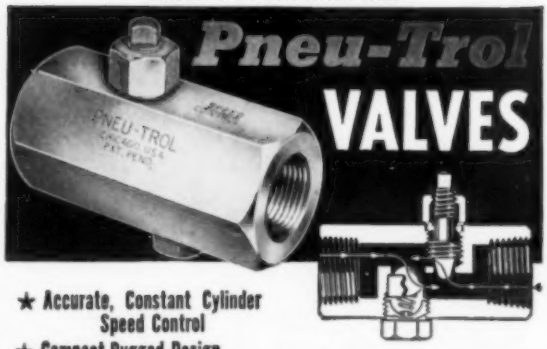
Stocks in all principal cities.

F FLODAR Corp.

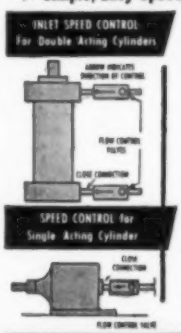
16911 ST. CLAIR AVENUE • CLEVELAND 10, OHIO

CIRCLE 95 ON TIME-SAVER CARD

Pneu-Trol VALVES



★ Accurate, Constant Cylinder Speed Control
★ Compact Rugged Design
★ Simple, Easy Speed Selection ★ For Air, Oil or Water Applications



Pneu-Trol Speed Control Valves are widely used in hundreds of control applications because they combine in a short, compact body, a tapered fine thread needle for extremely accurate air or oil flow control and a floating retro ball check, which permits full flow in the opposite direction. Retro ball floats in most sensitive position to its seat, requiring only a slight differential pressure to fully open or close it.

Needle design permits maximum flow capacity in the controlled direction. Metal to metal needle and ball seats insure long trouble-free service. Simple, practical "O" gland structure eliminates troublesome leaking. Valve bodies machined from hex brass or aluminum for 2000 psi working pressures; steel and stainless steel for 5000 psi. Made in 5 female pipe sizes—⅛" to ¾". ATTRACTIVE PRICES . . . IMMEDIATE DELIVERY.

Write for illustrated circular and prices.

Pneu-Trol DEVICES, INC.

1426 N. KEATING AVENUE • CHICAGO 51, ILL.

*SERIES CSH—3000 to 5000 psi HYDRAULIC

NEW!

SUPER DUTY* tapered cushion tie-rod type cylinders for EXTRA TOUGH applications!

- Square head, compact design requires less space.
- New tie-rod design, for greater shock load capacity.
- "Double-Seal" piston rings minimize gap flow, give maximum life.
- Sheffer pioneered tapered cushion piston decelerates motion gradually, minimizing "Cushion entrance" shock.
- Multi-lip rod packing is self-adjusting to wear, removable without disassembly of cylinder.
- Ports—straight thread or flanged, with "O" ring seal to eliminate leaks.
- Full range of bore sizes, 2"—12". Nine mountings!

Write, NOW, for Bulletin No. 1258

SHEFFER — THE SHEFFER CORPORATION

Cincinnati 15, Ohio • Phone: VAlley 1-0320

Manufacturers of the Industry's most complete line of air and hydraulic cylinders

SOLD BY LEADING DISTRIBUTORS NATIONWIDE

CIRCLE 39 ON TIME-SAVER CARD

CIRCLE 104 ON TIME-SAVER CARD

Valve design prevents creep

INGERSOLL MILLING MACHINE

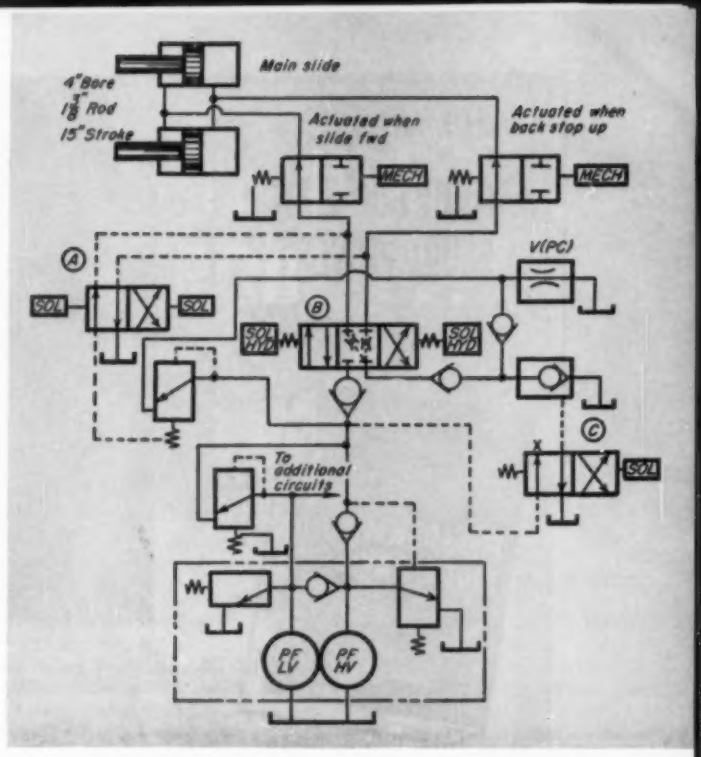
• By Martin H. Benston

SPOOL type valves have inherent leakage between the spool and sleeve, because of production tolerances to allow for thermal expansion of the valve parts and also to lubricate the spool. Although this leakage is small and can be disregarded in many installations, it can cause trouble where coordination between tool slides is critical.

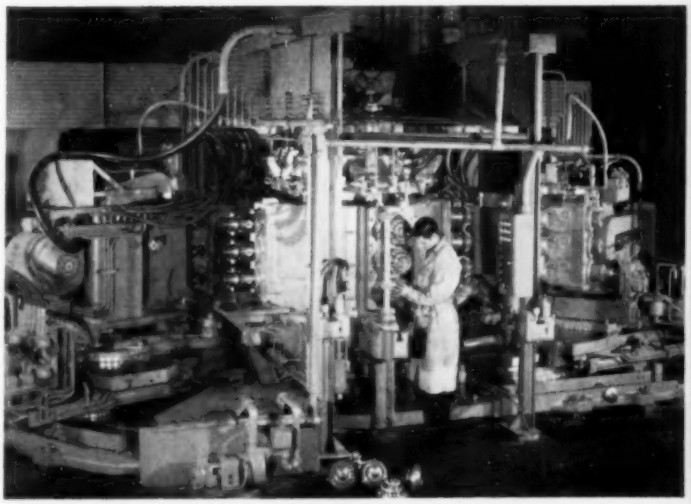
When engineers at Ingersoll Milling Machine designed a machine for milling bits for oil well drilling, they selected special valve spools for the 4-way directional valves which control the tool slides. Although these are closed center spools, with all ports blocked in the center position, they have been machined to provide small orifices between the cylinder ports and tank.

The combination pump which feeds this tool slide also supplies an additional tool slide and a clamping and indexing system. The pressure required to operate these additional systems is also applied to the directional valve controlling the main slide. Because of the leakage paths in the valve, this pressure is applied to the rod and head ends of the cylinders. The difference in areas causes the cylinders to extend at a rate controlled by metering in the valve leakage path. The orifices provided in the special spools used in this machine prevent pressure from building up on the cylinder when the valve is in neutral. The valve still acts as a closed center control, however, and locks the cylinder in position.

• **No-jump Control**—The speed of the tool slide is maintained by a pressure-compensated flow valve connected in a meter-out circuit. This valve has a compensator spool which adjusts an orifice controlling pressure on the metering orifice of the valve. When there is no flow through the valve, the compensator orifice is wide open. Therefore, the first flow through the valve is not pressure compensated, and this results in a lunging or jumping of the tool slide. To prevent this, a sequence valve has been connected to direct fluid through the flow control valve when valve *B* is centered. Valve *A* is sequenced with valve *B*, so that when pressure is applied to either end of the main slide cylinders, it is also applied to the spring cavity of the sequence valve. This pressure acts with the spring to hold the sequence valve closed.



VALVE *B* SYMBOL shows how cylinder ports are connected through orifices to tank when the valve is centered. These orifices are made by machining the spool. Valve still keeps closed-center characteristics.



SMOOTH, ACCURATE SPEED CONTROL on this special milling machine for oil well drilling bits is accomplished by careful selection and arrangement of the hydraulic valves.

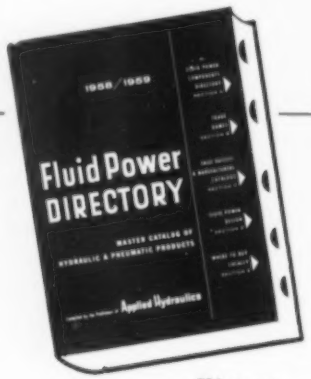
• **Traverse-Feed**—During rapid traverse of the tools, valve *C* is energized. It directs fluid to open the pilot-operated check valve permitting free flow to tank rather than through the flow control valve. Just before the tool meets the work, valve *C* is deactuated by a limit switch. ▼▼▼

MARTIN H. BENSTON, *Hydraulic Engineering Supervisor, Ingersoll Milling Machine Co., Rockford, Ill.*

Order now!

YOUR GUIDE TO FLUID POWER!

$6.50



796 pages

THE MOST WIDELY USED REFERENCE FOR HYDRAULICS AND PNEUMATICS

More than 17,000 copies of this 1958/59 Directory are now being used in industry to help technical and management men select fluid power components, find suppliers, learn about standards and circuit design.

FIVE CONVENIENT, THUMB-INDEXED SECTIONS FOR QUICK, EASY REFERENCE

- **Fluid Power Components**
  Listing 140 products and the more than 650 companies who make them.
- **Trade Names**
  Helps find the manufacturer when only a trade is known.
- **Manufacturer's Catalogs**
  348 pages of product specifications. Locations of sales offices are listed.
- **Fluid Power Design**
  224 pages of standards, circuits and data
- **Where to Buy Locally**
  Index to independent sales companies.

CLIP AND MAIL

FLUID POWER DIRECTORY
812 Huron Road
Cleveland 15, Ohio

Please send ..... copies of the 1958/59 Fluid Power Directory @ $6.50 each. ($7.50 for foreign orders)

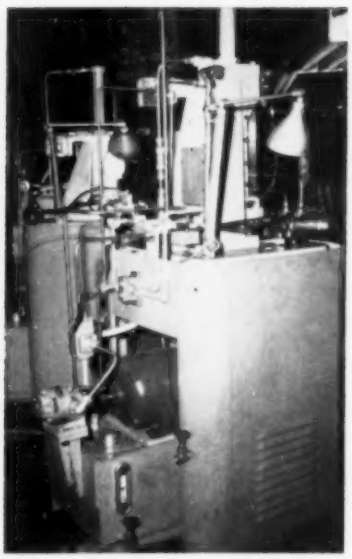
Name .....

Company .....

Address .....

City .....

MANY SMALL PARTS can be machined faster and better by broaching than milling. This machine can produce over 1500 per hour.



BROACH CYLINDER IS POWERED by 5-gpm vane pump. Direction is controlled by direct, solenoid-operated, $\frac{3}{8}$-inch, 4-way valve.

Limit switches sequence vertical broach

BOND TOOL MFG. CO.

• By John A. Tartaglia and Walter H. Blackler

AN electrical system actuated by pushbuttons and limit switches sequences the hydraulic broach cylinder and the air clamping fixture on this 2-ton broach. Three modes of operation can be selected by a switch. These are jog, half cycle, and full cycle. In the jog operation, for set-up, the broach cylinder moves up or down as long as pushbuttons are held.

The half cycle sequence is for very precise work. When a pushbutton is pressed, the work is clamped and the cylinder moves down. The cylinder stops at the bottom of its stroke, and the clamp opens for removal of the part. A second push button is then pressed to return the cylinder for another cycle. This operation is not as fast as the full cycle, but it produces a better finish on the work, and gives longer tool life. For high speed operation, the full cycle is electrically selected. In this operation, the clamp closes, the broach comes down and returns, and the clamp opens.

Three limit switches sense the positions of the broach cylinder and the clamp fixture. Two of these are actuated when the cylinder is in its extreme up or down position. The third has a push type actuator and is tripped when the clamp is fully closed.

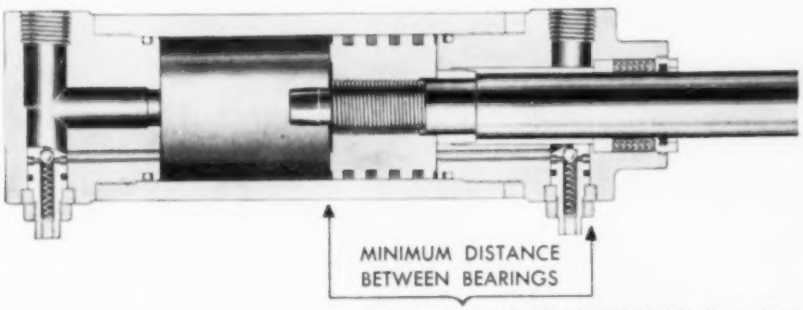
• **Fluid Power Components**—The 2-inch bore broach cylinder is powered by a 5-gpm vane pump. Operating pressure is about 1000 psi. A $\frac{3}{8}$-inch direct, solenoid-operated valve with tandem neutral position controls the broach cylinder. The air-operated clamping fixture is designed according to the part being machined. In one application it uses two small air cylinders of $1\frac{1}{8}$ and 2-inch bores controlled by a $\frac{1}{4}$-inch, double solenoid, 4-way valve. ▼▼▼

JOHN A. TARTAGLIA, *President, Bond Tool & Mfg. Co., Waterbury, Conn.*

WALTER H. BLACKLER, *President, Pneumatic Engineering Co., Hartford, Conn.*

We'd Like To Make a POINT...

ONLY *Pathon* HYDRAULIC CYLINDERS GIVE YOU ADEQUATE SPACE BETWEEN BEARING POINTS . . .



You Get These 5 Important Advantages:

1. Increased rod bearing life
2. Increased rod seal life
3. Reduced power eating friction
4. Eliminates rod cocking at end of out stroke, providing more rigid unit
5. Eliminates need for internal spacers

This space allowed between the two bearing points keeps the unit loading on rod bearings to a minimum. While we do not recommend extreme side loading of hydraulic cylinders when this condition is unavoidable, Pathon cylinders are best.

Ψ could designate P. S. I.-102

Pathon
MANUFACTURING CO.

WRITE TODAY FOR CATALOG
3823 PACIFIC AVENUE
CINCINNATI 12, OHIO

to keep
valves free and
functioning
properly . . . . .

FERRO FILTER®

MAGNETIC SEPARATORS

Shown is high pressure model P2H50 for service to 5000 psi. Other models for low pressure rated at 100 psi.

And Here's
How It's
Done

Fluid passes through a stack of grids (lower right) magnetized by two powerful Alnico magnets (upper right, lower left). The "honeycomb" design of the grids splits the flow into thin streams, allowing fine particles of iron, rust and scale to be caught and held on the grid edges.

Send for BULLETIN PM-65

S. G. FRANTZ CO., INC.

Brunswick Pike & Kline Ave.
P. O. Box 1138 Trenton 6, N. J.

CIRCLE 41 ON TIME-SAVER CARD

Multiple spindle drill feeds

TURNER BROTHERS INC.

• By R. Johnson

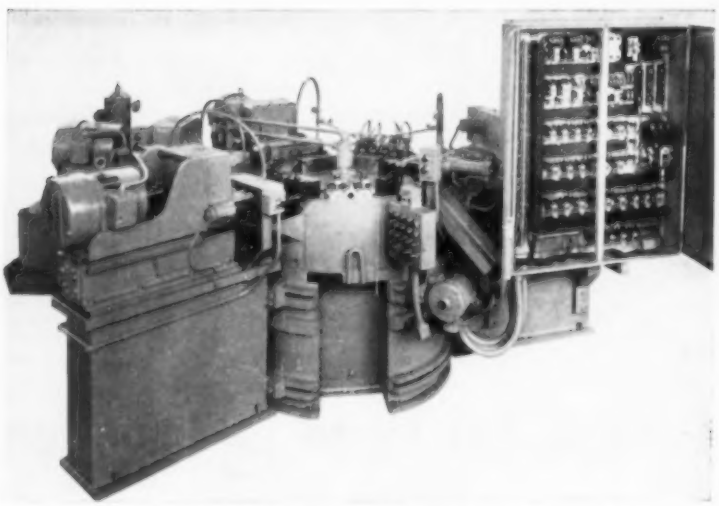
PUMP and flow control valves, both pressure compensated, give smooth, accurate drill speeds on this rotary index machine.

• **Feed Control**—Each drilling station has one inline fixed flow control valve that meters-in on the work stroke for rapid traverse. As the drill approaches the work, a limit switch energizes the solenoid shut-off valve, directing flow from the rod end of the cylinder through the adjustable flow control valve. Tool feed is controlled by the setting of this valve.

For rapid return, the adjustable flow control valve is by-passed and the cylinder is retracted at a rate set by the fixed flow control valve.

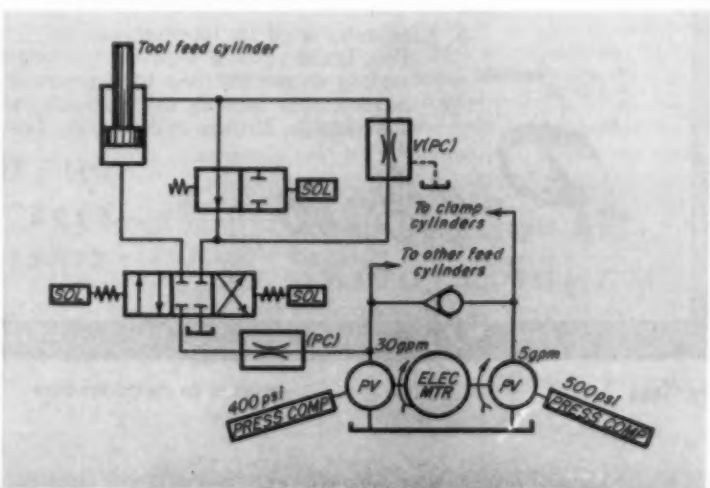
• **For better maintenance**—Only standard hydraulic components are used to simplify replacement. Cylinders in the slide units are flange mounted on the blank end. They are removed by unbolting the back plate and disconnecting the plumbing. ▼▼▼

R. JOHNSON, *Design Engineer, Turner Bros. Inc., Ferndale, Mich.*



ALL VALVES and cylinders are standard for simple maintenance.

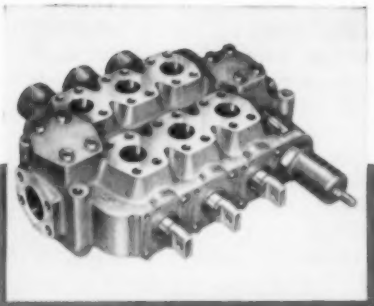
METER-IN CIRCUIT controls rapid traverse, Meter-out circuit with 2-way solenoid valve controls tool feed.



Save Power on Your Mobile Equipment with—

HYDRECO

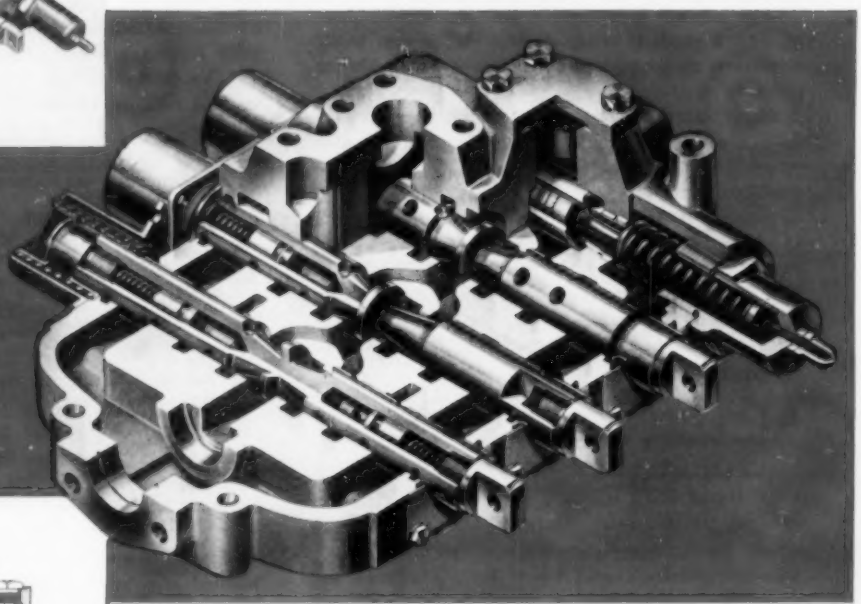
HOLLOW PLUNGER FLUID POWER VALVES

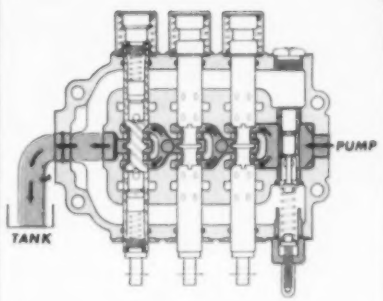


5 to 150 gpm

1 to 6 Plungers

2000 psi





Schematic sketch of the V-26 three-plunger HYDRECO Valve showing the exclusive Hollow-Plunger design. Note the restriction-free idling flow path and exclusive, patented check valves built into the Hollow-Plungers to prevent back-flow from cylinders or fluid motors.

When you consume fluid power needlessly you suffer not only waste of power, but also excessive heat generation. This multiplies many problems—wear, pump slippage, and deterioration of seals and hydraulic fluid.

HYDRECO Valves are designed with exceptional efficiency to take advantage of this opportunity to economize. They provide an idling flow path around the plungers that is more than ample . . . actually twice normal size. Back pressure during idling is negligible . . . horsepower consumption is therefore less.

This is but one of many significant plus factors in HYDRECO engineering. It also is one of the reasons why the HYDRECO Plunger design gives greater dependability, power-saving control and ease of operation to outstanding earth moving, farm and materials handling applications.

Member NFPA

Write . . .

for detailed information on the full line of HYDRECO Hollow Plunger Valves.

Kalamazoo Division
The New York Air Brake Company
9004-7 East Michigan, Kalamazoo, Mich.
Please send me bulletins fully describing HYDRECO Valves for Mobile Equipment.

Name_____

Company_____

Address_____

City_____ Zone_____ State_____

THE NEW YORK AIR BRAKE COMPANY

KALAMAZOO DIVISION • KALAMAZOO, MICHIGAN

CIRCLE 65 ON TIME-SAVER CARD

Concluded from page 62

• User looks at electro-hydraulic servo valve.

The outstanding advantages of servo valve controlled fluid motors for powering slides were cited by R. K. Sedgwick in his paper on application of servo valves. These are: (a) rapid acceleration with high available torque, (b) "stiff" system without appreciable elastic deflection, (c) control of a large amount of hydraulic and mechanical power with a small amount of electrical power, using miniature components, (d) flexibility with simple pressure control.

After describing basic valve types, he gave performance results of machines using servo valve control. "Some of our later machines . . . have positioned fifty times consecutively with a mean dispersion of .00008 in and a maximum of .0002 in" he said. What's needed in servo valves? The ruggedness of spool type valves should be combined with the performance of flapper-nozzle valves. Electrical connections should be standardized, valves should have mounting interchangeability.

• What improvements have there been in deceleration valves?

The big problem has been how to use the full spool travel when the flow rate was less than the capacity of the valve. Only the last part of the spool travel caused deceleration, so cam design was critical. In a new valve, soon available, the free-flow capacity will be adjustable for each application. The full spool travel will then control flow simplifying cam design. An adjustable needle valve will permit some bypass flow for creep of the cylinder to a positive stop.

• What are the application factors of oil-immersed solenoids?

In a heating test for 8 hours, temperature of an oil-immersed solenoid rose slightly faster than an open solenoid, but after about 7 hours, temperature of both leveled off at about 210 F. Al Schaljo of Ford Motor pointed out that cycling can make a big difference in solenoid heating, and he cited one of his applications where the solenoid covers have been removed for cooling, but the valves are still operating too hot to touch. Biggest advantages of oil-immersed solenoids is longer life.

• How do pilot-operated pressure reducing valves compare with direct acting valves?

Because direct acting, pressure reducing valves start closing as outlet pressure reaches valve setting, they are faster acting than pilot-operated valves which can permit over-pressure surges. A restriction at the outlet port will often eliminate the momentary over-pressure. Relief valves were also suggested for one job using reducing valves connected into a blocked flow condition.

• Preventive Maintenance

"Industry is spending upwards of 11 billion dollars a year for maintenance." This was a jolting opening remark from Cliff Bonnell, Vickers' service manager who went on to outline practices to reduce breakdowns. What are the first steps in reducing maintenance costs? Set up a schedule of inspection and service. Educate maintenance men to recognize symptoms such as noisy pumps and valves, foaming oil, shock and vibration, high oil temperature, low pressure. Check your inventory of spare parts. Check equipment work load for best concentration of maintenance. Get to know your suppliers, find out what services they offer. J. J. Yates of GMC's Detroit Diesel Division created interest with his simple card system to schedule oil maintenance, and T. F. Kitilson of Sperry Gyroscope agreed that such a system is a job to set up, but it then runs very smoothly.

• Best tube fittings?

Opinions varied widely on merits of flare, compression, and O-ring fittings of different design. William Bayley, A. C. Spark Plug likes the long grip of a self-flaring fitting. He's had trouble with an O-ring fitting and said it's because tubing was not round. Ed Lerczak said that either flare or flareless fittings will do the job if they are installed right. Support of tubing is very important in controlling leakage. He gave his specifications for spacing tube supports, ranging from 3 ft for ¼-in. tubing to 9 ft for 1½-in. tubing. Robert Guy, Detroit Transmission Div. GMC wants fittings that lock up like a lock washer and also have a dead stop when they're tight. Art Phillips also mentioned that compression fittings require a specific torque, and the tendency is for maintenance men to overtighten.

• Straight Threads—When?

Most designers agree they're better; few want to try them. Everyone's waiting to see what the next one's doing. "We spend $3000 to $5000 a month for leakage in starting up a new plant," said J. R. Cypher of Chrysler. "We're certainly going to use straight threads. But a recent survey shows that less than 10% of hydraulic components are supplied with straight thread ports."

• What's the future for Nylon tubing?

General Electric's D. C. Stoneman said his company is using Nylon tubing with good results. It's light and easy to handle and can be used with standard metallic fittings. But it must be protected from sharp edges and heat. "We're using it for 400 psi and expect to use more, especially in pilot lines," he said.

• Standard for welded tubing.

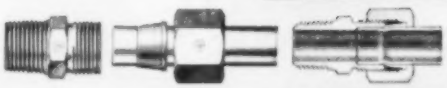
Robert Guy indicated that GM's specifications for welded tubing is tougher than for seamless. Frank Mackin of GM Institute said that they are testing welded tubing which equals or exceeds seamless, and that GM is working up a spec for presentation to JIC. ▼▼▼

Best for your product, too!

SAE 45° FLARE

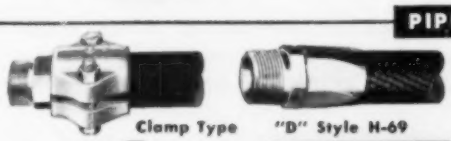
INVERTED FLARE

COMPRESSION



SELFALIGN®

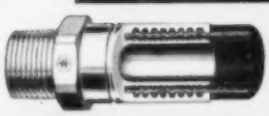
PIPE



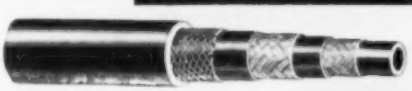
Clamp Type "D" Style H-69

Barb-Tite Push-On Hose End

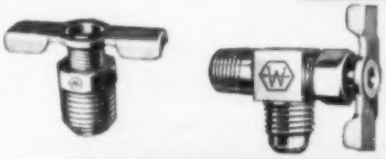
REUSABLE HOSE ENDS



SWAGED HOSE ASSEMBLIES



BULK HOSE

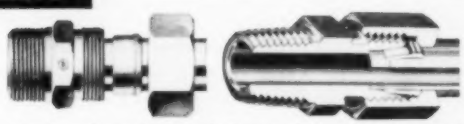


DRAIN AND SHUTOFF COCKS

WEATHERHEAD

EVERY COMPONENT TO MEET ANY HYDRAULIC REQUIREMENT

ERMETO®



Steel and stainless steel Ermeto fittings in sizes and types to meet any need. No flaring, threading, welding or soldering.

STRAIGHT-THREAD ERMETO

Straight-thread Ermeto meets new S.A.E. Boss specifications. Closer coupling; higher PSI without backup rings. New "Weathercote" finish for greater corrosion resistance.

S.A.E. 37° FLARE-TWIN (J.I.C.)

3-PIECE

2-PIECE

37° flared fittings available with dryseal pipe-thread or with new straight-thread in popular styles and sizes for S.A.E. O-ring design boss. Withstands higher pressures without backup rings. Easier assembly, closer coupling. Corrosion-resistant "weathercote" finish.

Available through Weatherhead coast-to-coast list of leading Industrial Distributors.

WEATHERHEAD

FIRST IN HYDRAULIC CONNECTIONS

THE WEATHERHEAD CO., FORT WAYNE DIVISION

Dept. A-7 128 West Washington Blvd., Fort Wayne, Indiana

In Canada: The Weatherhead Co., Ltd., St. Thomas, Ontario

CIRCLE 131 ON TIME-SAVER CARD

New Design Versatility with RŌTAC

Compact, powerful Rōtac Torque Actuators have a wide range of applications

RŌTAC Rotary Torque Actuators consist of a cylindrical chamber containing a stationary barrier or shoe, and a central shaft with a fixed vane. With fluid or pneumatic pressure applied to either side of the vane, rotary movement in the opposite direction is obtained; power can be doubled by using double-vane shafts. One moving part insures long life and low maintenance.

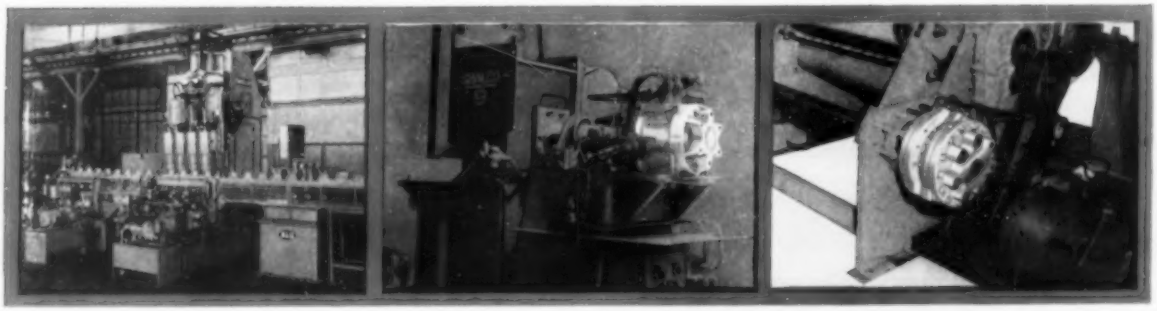
Rōtac Actuators can be mounted vertically, horizontally or at any angle, with the housing held stationary or with the body rotating around the shaft.

Wherever you need motion—powerful, easily controlled rotary action in compact form—Rōtac Actuators simplify design and provide unlimited possibilities for use in various applications.

FREE DESIGN DATA BOOK—20 PAGES

Contains everything you'll want to know about RŌTAC—How it works • Control • Typical applications and special uses • Installation details • Dimensions • Torque ratings • Helpful ideas for using RŌTAC Actuators in your operations.

MOBILE EQUIPMENT—A compact RŌTAC Torque Actuator swings this truck-mounted crane boom in a 280° travel arc; it's controlled through a 4-way valve.



MACHINE TOOLS—Automation machine for boring and grooving piston wrist pin holes uses RŌTAC Torque Actuator for positioning the orienting arbors.

FOUNDRY MACHINERY—Ex-Cell-O Model HN-66-1V RŌTAC Actuators supply the motive power for turnover of the core-box on this semi-automatic shell core blower.

PAPER MACHINERY—This collector roll is actuated by a standard model RŌTAC Actuator which unloads material after a slitting operation is performed.

EX-CELL-O CORPORATION

XLO EX-CELL-O FOR PRECISION

EX-CELL-O PRECISION PRODUCTS INCLUDE:
* MACHINE TOOLS • GRINDING AND BORING SPINDLES
* CUTTING TOOLS • RAILROAD PINS AND BUSHINGS
* DRILL JIG BUSHINGS
* AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS
* TORQUE ACTUATORS • DAIRY EQUIPMENT

58-15

GREENVILLE PLANT, GREENVILLE, OHIO

CIRCLE 37 ON TIME-SAVER CARD

AVIATION SECTION

CIRCUIT IDEAS FROM FRENCH JET TRANSPORT 100

By Robert Blanchet

Details of some of the most interesting features of the hydraulic system of the Caravelle: Flight control surface actuators, artificial pilot feel system, and followup control of the flap-positioning valve.

CALCULATING SPRING CONSTANTS FOR CYLINDERS 104

By George R. Lay

Air loads at high speeds can stretch hydraulic cylinders and compress the fluid in the cylinder. When this would cause a flap to be moved out of position, deflection due to these spring constants must be calculated and corrections made.

AVIATION NEWS FROM THE FLUID POWER FIELD 108

AVIATION COMPONENT DATA 110

EDITORIAL ADVISORY BOARD

WAYNE S. BOALS Pantex Mfg. Corp. • **HAROLD E. WELLS** Bendix Aviation Corp. • **H. G. CONWAY** Short Bros & Harland, Ltd. • **RALPH E. MIDDLETON** Lockheed Aircraft Corp. • **HOWARD FIELD, JR.** Convair, A Division of General Dynamics Corp. • **W. F. TALBOT** Northrop Aircraft, Inc. • **ALBERT WEISSKOPF** Grumman Aircraft Engineering Corp. • **KENNETH W. DUBOIS** Douglas Aircraft Co.

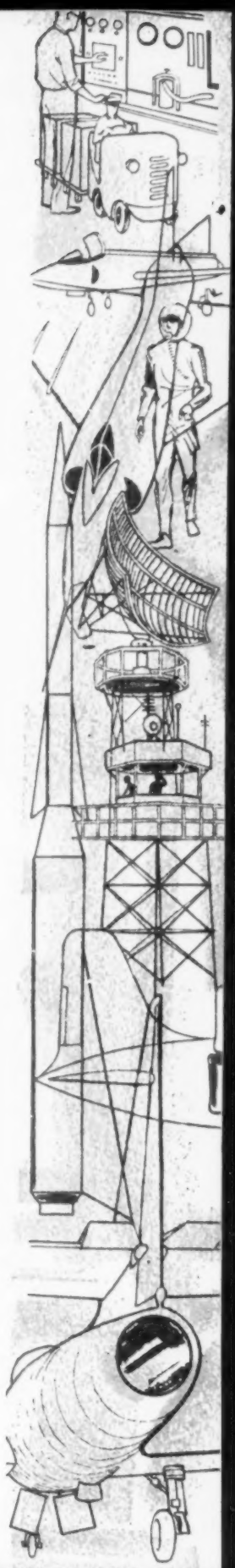


FIG. 1. THE TWIN-JET CARAVELLE has its engines mounted at the rear of the fuselage. Cruising speed is 515 mph.

Another recent entry in the jet transport race is the French-built Caravelle. Produced by Sud Aviation Corp. of Paris, its hydraulic system includes some very interesting features.

- Control Surface Actuators
- Artificial Feel System
- Flap Position Followup

Circuit ideas from French jet

• By Robert Blanchet, *Sud Aviation Corp., Paris, France*

AS do most new large transport aircraft, the twin-jet Caravelle Figure 1, uses hydraulics for many functions, Figure 2. As in all aircraft, reliability was designed into the system. Figure 2 shows the duplication of pumps to provide alternate pressure sources should an engine or pump fail.

• **Servodynes**—One of the outstanding hydraulic features is the control surface actuator-valve package, made by Automotive Products Co. Ltd. of England. The actuators, Figure 3, are called Servodynes. They are made up of two pistons, hydraulically independent, in a common body; two servo valves, mounted on the body, and an input control lever that connects to the valve spools through a force limiting and warning device. Piston rods extend from both ends of the body and are used to mount the Servodyne. Mechanical output and input connections are at the center of the moving body. Pressure is supplied through rigid tubing connected to the rod ends. Hoses are used only for the low-pressure return lines.

Pressure is always applied to the rod ends of the Servodyne. Movement in either direction is started by connecting the blank end of the cylinder to pressure or to tank. If pressure is applied to the blank end of one piston, the blank end of the other Servodyne piston is connected to tank so forces on both pistons act in the same direction.

Because piston rod area is half the piston area, this system produces the same force output for either direction of motion. Servodyne's total force output is about twice that of a double-rod actuator of the same diameter.

A spring loaded plunger, built into the Servodyne piston, keeps control surface overloads from damaging the surface due to hydraulic locking of the surface. When safe load is exceeded, the valve opens, lets the surface move,

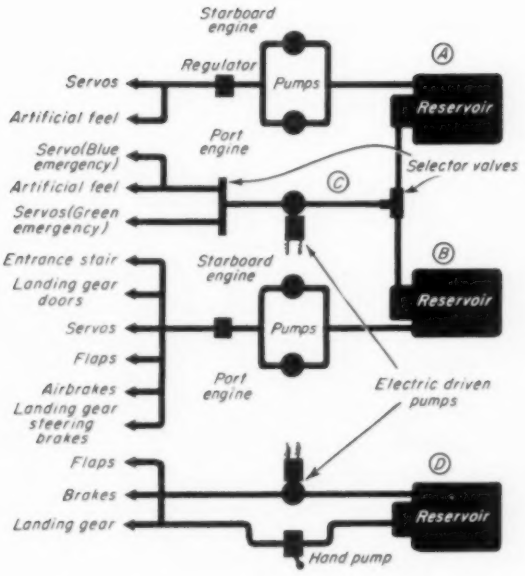


FIG. 2. MULTIPLE HYDRAULIC power sources insure hydraulic system reliability. Two normal systems, A and B, two emergency systems, C and D are used.

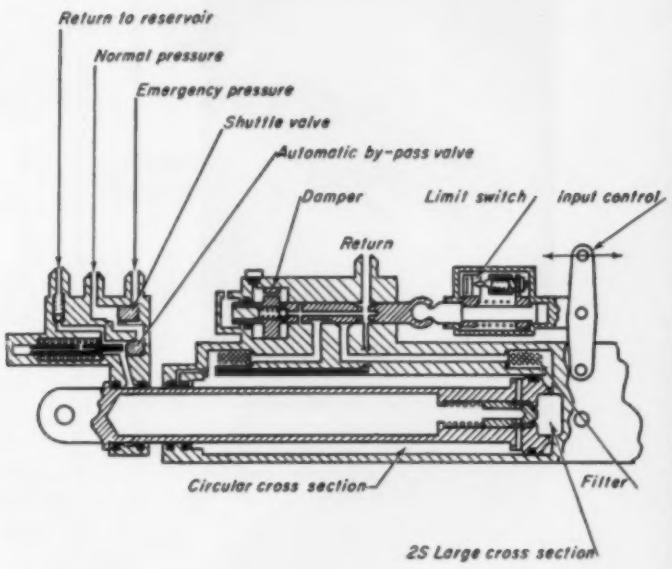


FIG. 3 CUTAWAY VIEW of one of the flight control surface power controls—a Servodyne. Units for all control surfaces are identical.

transport

and fluid flows to the tank. Another interesting point is the use of a spring connection between the input link and the servo valve plungers. If a valve plunger freezes in the body, the spring gives and lets the other valve work. A limit switch in the spring connector housing is closed when this happens to light a warning light and let the pilot know that he has a stuck valve and that one section of the Servodyne is not working. The pilot can then connect the faulty half to tank so it does not interfere with the other section.

• **Artificial feel**—Two methods are used to provide artificial control surface "feel." Torque rods

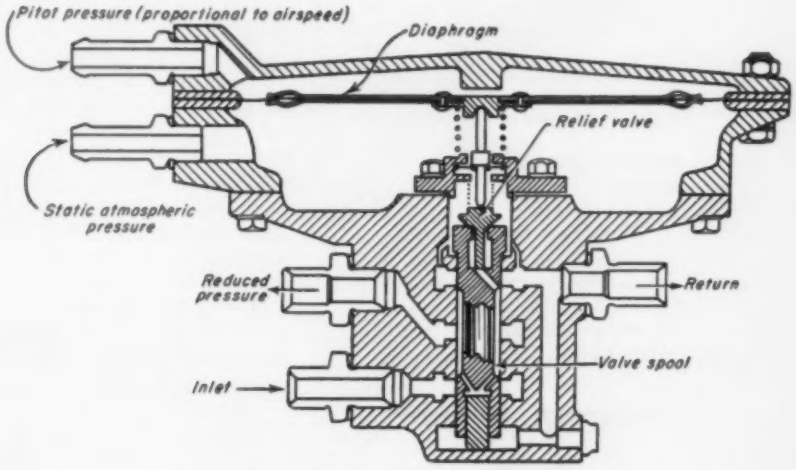
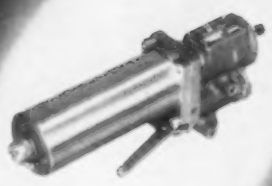


FIG. 4. PRESSURE PROPORTIONAL to airspeed is applied to cylinders connected to the aircraft control column and pedals to provide artificial feel. This pressure reducing valve supplies the pressure proportional to airspeed.

BRAKE VALVES



By
M. C. MFG. CO

a leader in the development and manufacture of dependable, lightweight, hydraulic, pneumatic and fuel components

The picture above shows the
MC 4351
VALVE AND COMPENSATOR—
PARKING BRAKE
For Aircraft Brake Systems

Characteristics

TYPE: Controllable Check with 2-Stage, Spring Loaded Compensator
FLUID: Hydraulic per MIL-O-5606
TEMP. RANGE: −65° F to +160° F
COMPENSATOR—FIRST STAGE:
Begins Charging at 230 ± 20 PSI
Fully Charged at 500 ± 20 PSI
Capacity .50 in.³
COMPENSATOR—SECOND STAGE:
Begins Charging at 650 ± 25 PSI
Fully Charged at 1100 ± 100 PSI
Capacity .50 in.³
INTERNAL LEAKAGE: None
WEIGHT: 3.4 Lbs.

Other Precision Products

VALVES OF ALL TYPES: Brake • Control • Manual • Pressure Reducing • Relief • Restrictor • Shuttle • Solenoid • Special • Transfer
ALSO: Air Compressors • Dehydrators • Fuel Pumps

M. C. MANUFACTURING CO.
Mail: P.O. Box 126
Plant: 118 Indianwood Road
LAKE ORION, MICHIGAN
WEST COAST OFFICE
716 Wilshire Blvd., Santa Monica, Calif.
Representatives:
D. & O. ENGINEERING CO.
P.O. Box 3107, Wichita, Kansas
F. C. MINCH
1132 Donson Drive, Dayton 10, Ohio

CIRCLE 76 ON TIME-SAVER CARD

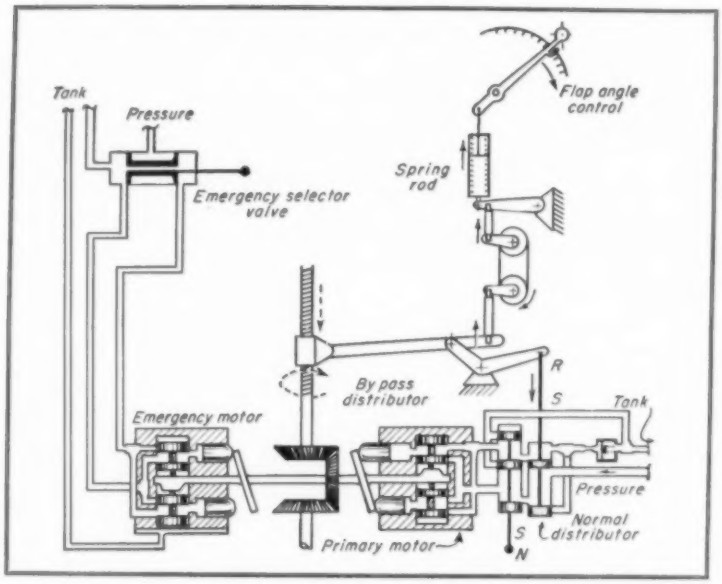


FIG. 5. THIS LINKAGE provides mechanical follow-up to stop the wing flap drive motor when flaps are positioned at a selected angle.

are connected to the control column and pedals to give feel proportional to column or pedal deflection. This can be compared to working against springs. The further the spring is stretched, the greater the force needed.

Feel proportional to airspeed is gotten with a hydraulic system. Three cylinders give rudder, elevator, and aileron feel. The cylinders exert a force opposite the force exerted by the pilot. A pneumatically-operated, pressure-reducing valve, Figure 4, applies pressure to the cylinders proportional to airspeed.

Atmospheric pressure is applied to the bottom of the diaphragm that operates the feel valve. Pitot pressure, proportional to airspeed is applied to the top of the diaphragm. As Figure 4 shows, an increase in Pitot pressure moves the valve spool down, tending to apply full inlet pressure to the reduced-pressure port. The balance between Pitot and atmospheric pressures determines the reduced pressure applied to the feel cylinders. A relief valve in the feel valve spool limits maximum pressure applied to the feel cylinders.

• **Flap positioning**—Wing flaps are extended or retracted by hydraulic motors that drive the flaps through screws. Both a normal motor and an emergency motor are used. The normal motor's control is an interesting mechanical linkage on which the pilot sets the required flap position on a quadrant. The linkage automatically stops the motor when the set position is reached.

The linkage is shown in Figure 5. When the flap angle control is set, a spring is compressed or stretched. This spring acts against a linkage to displace the motor control valve spool. One member of the linkage is coupled to and driven by the screw that operates the flaps. As the screw rotates, this link is moved to release tension or compression of the spring and to return the valve spool to the neutral or off position. When the flap has moved to the selected position, the valve spool is returned to neutral, and the motor stops.

Should primary hydraulic power fail, secondary power may be applied to the emergency hydraulic motor for flap positioning. Follow-up control is not included in the emergency control. A bypass valve lets both parts of the primary motor be connected to tank when the emergency motor is used. ▼▼▼

PARCO GIVES YOU PERFECT SEALING FOR EVERY O-RING APPLICATION

You, too, can plan on and get perfect sealing with Parco O-Rings. For missiles...rockets...or profit-conscious ground industries...Parco O-Rings are compounded from years of sealing know-how to assure perfect seals despite the most critical requirements. And Parco's engineering experience is always available to your drafting rooms to overcome sealing problems before they occur in operation. Combine this industry-leading service in tailor-made Parco O-Rings with on-time deliveries of standard Parco O-Rings from inventory and you have the answer to every need for exacting performance in sealing. Write for free Parco O-Ring Technical Data Reference Log #1581.

PARCO PLASTIC AND RUBBER PRODUCTS COMPANY, 2100 HYDE PARK BOULEVARD, LOS ANGELES 47, CALIFORNIA

Calculating spring constants for hydraulic cylinders

• By George R. Lay, *Design Engineer, Hydraulics Section, McDonnell Aircraft Corp., St. Louis, Mo.*

AIRLOADING can move flaps, speedbrakes, and spoilers on high-performance aircraft from their retracted position, see Figure 1. To prevent this, an initial load or deflection must be applied to the system to counter balance the air load. Proper load is determined by spring constants of the surface, hydraulic actuator, hydraulic fluid, linkage connecting actuator anchor.

As an example, let's look at the speed brake flap in an aircraft wing, Figure 1. When fully retracted, with no preload applied and no air load, it would be flush with the upper surface of the wing. But with the aircraft moving at 600 to 800 knots, a lifting force of 10,000 lb might be applied. It would lift the flap so it would no longer be flush with the wing surface because flap, linkage, piston rod, hydraulic fluid, etc. all would give a little under the 10,000-lb load. Total deflection of the surface would, of course, depend on the spring constants of all these.

This condition cannot be tolerated in a high-performance airplane because the flap would increase drag and disturb airflow over the wing.

The cure is to calculate the deflection for the expected air load and apply enough preload to keep the flap from moving outside the flush position. This article describes the method of doing this for the hydraulic cylinder.

• **Calculations**—In general, the linear spring constant,

$$K_l = \frac{P^2}{2U} \qquad (1)$$

where K_l = Linear spring constant, lb/in.,
P = applied load, lb,
U = strain energy, in.-lb,

and torsional spring constant,

$$K_t = \frac{M^2}{2U} \qquad (2)$$

where M = applied moment in.-lb,
K_t = torsional spring constant, in.-lb/rad.

Total spring constant for an actuator, assuming that the fluid is incompressible is found from

$$K_T = \frac{P^2}{2(U_1 + U_2 + \ldots U_n)} \qquad (3)$$

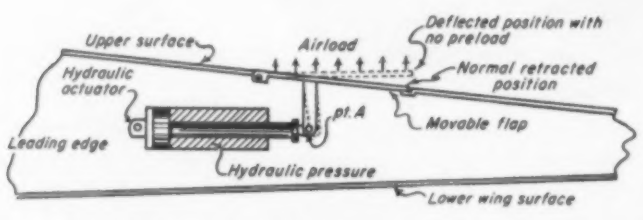


FIG. 1. AIR LOADS can deflect flaps on an aircraft surface from their required flush position. This article tells how to compute the additional stroke required to prevent this deflection.

where, U_1, U_2 ... U_n = strain energies of the cylinder parts.

Spring constant for the actuator with compressible fluid is found from

$$K_T = \frac{K_c K_f}{K_c + K_f} \qquad (4)$$

where K_T = total spring constant, lb/in.,
K_c = cylinder spring constant, lb/in.,
K_f = fluid spring constant, lb/in.

and the fluid spring constant is gotten from

$$K_f = \frac{EA^2}{V} \qquad (5)$$

where E = bulk modulus of the fluid, psi
A = piston area, sq in.,
V = fluid volume, cu in.

To find the spring constant of the actuator, only the strain energies having the greatest effect are used. These are: axial load on the piston rod, hoop tension in the cylinder barrel, end cap bending and the axial load on the cylinder barrel. For the axial loads, strain energy is found from

$$U = \frac{P^2 L}{2EA} \qquad (6)$$

where U = strain energy, in.-lb,
P = tensile force, lb,
L = effective length of the rod or cylinder barrel, in.,
E = modulus of elasticity, psi,
A = cross-section area, sq in.

Hoop tension in the barrel is found from

$$U_H = \frac{p^2 d^2 L D\pi}{8tE} \qquad (7)$$

CIRCLE 124 →

USE ONE OF THESE TIME-SAVER CARDS...

...for more information on advertised products, new components, useful literature, etc. Just circle item number and drop in the mail.

Index to NEW PRODUCTS, USEFUL LITERATURE and AVIATION COMPONENT DATA

By Item Numbers

New Products

Descriptions start on page 50

SOLENOID VALVE 300
Mechanical Air Controls
STRAIGHT THREAD FITTINGS 301
Flodar Corp.
OIL FILTER 302
Bendix Filter Div.
HAND PUMP 303
William S. Pine
LIMIT SWITCHES 304
R. B. Denison
HYDRAULIC CYLINDER 305
Tompkins-Johnson Co.
SQUARING AND BURRING TOOL 306
Parker Fittings and Hose Div.
ROTARY VACUUM PUMP 307
Leiman Bros. Inc.
LEVER OPERATED VALVE 308
Valvair Corp.
IN-LINE FLOW REGULATOR 309
Fluid Power Accessories Inc.
AIR & OIL CYLINDERS 310
S-P Mfg. Corp.
OIL FILTERS 311
Commercial Filters Corp.
PRESSURE GAGES 312
United States Gage
DIRECTIONAL VALVE 313
Dynex Inc.
HYDRAULIC CHECK 314
Appco Corp.
AIR FILTER 315
Gits Bros. Mfg. Co.
HYDRAULIC PUMP 316
Vickers Inc.
FOUR-WAY VALVES 317
Rivett, Inc.
CUSHION VALVE 318
Numatics, Inc.
O RINGS 319
Minnesota Rubber Co.
PRESSURE REGULATORS 320
C. A. Norgren Co.
NYLON FLARE NUTS 321
The Polymer Corp. of Penna.
HYDRAULIC CYLINDER 322
Green Mfg. Co.
TUBE BENDER 323
Leonard Precision Products Co.

Useful Literature

Descriptions start on page 58

HYDRAULIC SERVO 400
Behlen Mfg. Co.
HYDRAULIC POWER UNIT 401
Double A Products Co.
AIR VALVES 402
Ross Operating Valve Co.

Continued on other side

JULY, 1958 — Circle number to receive free information about any product described or advertised in this issue.

ADVERTISERS

1	21	41	61	81	101	121	141	161	181	201	221
2	22	42	62	82	102	122	142	162	182	202	222
3	23	43	63	83	103	123	143	163	183	203	223
4	24	44	64	84	104	124	144	164	184	204	224
5	25	45	65	85	105	125	145	165	185	205	225
6	26	46	66	86	106	126	146	166	186	206	226
7	27	47	67	87	107	127	147	167	187	207	227
8	28	48	68	88	108	128	148	168	188	208	228
9	29	49	69	89	109	129	149	169	189	209	229
10	30	50	70	90	110	130	150	170	190	210	230
11	31	51	71	91	111	131	151	171	191	211	231
12	32	52	72	92	112	132	152	172	192	212	232
13	33	53	73	93	113	133	153	173	193	213	233
14	34	54	74	94	114	134	154	174	194	214	234
15	35	55	75	95	115	135	155	175	195	215	235
16	36	56	76	96	116	136	156	176	196	216	236
17	37	57	77	97	117	137	157	177	197	217	237
18	38	58	78	98	118	138	158	178	198	218	238
19	39	59	79	99	119	139	159	179	199	219	239
20	40	60	80	100	120	140	160	180	200	220	240

NAME

POSITION:

COMPANY:

PRODUCT MFG.:

STREET

CITY ZONE STATE

Do not use after 10-15-58

NEW PRODUCTS

300	305	310	315	320	325	330	335
301	306	311	316	321	326	331	336
302	307	312	317	322	327	332	337
303	308	313	318	323	328	333	338
304	309	314	319	324	329	334	339

FREE LITERATURE

400	405	410	415	420	425	430	435
401	406	411	416	421	426	431	436
402	407	412	417	422	427	432	437
403	408	413	418	423	428	433	438
404	409	414	419	424	429	434	439

AVIATION DATA

500	505	510	515	520	525	530	535
501	**506**	**511**	**516**	**521**	**526**	**531**	**536**
502	507	512	517	522	527	532	537
503	508	513	518	523	528	533	538
504	509	514	519	524	529	534	539

JULY, 1958 — Circle number to receive free information about any product described or advertised in this issue.

ADVERTISERS

1	21	41	61	81	101	121	141	161	181	201	221
2	22	42	62	82	102	122	142	162	182	202	222
3	23	43	63	83	103	123	143	163	183	203	223
4	24	44	64	84	104	124	144	164	184	204	224
5	25	45	65	85	105	125	145	165	185	205	225
6	26	46	66	86	106	126	146	166	186	206	226
7	27	47	67	87	107	127	147	167	187	207	227
8	28	48	68	88	108	128	148	168	188	208	228
9	29	49	69	89	109	129	149	169	189	209	229
10	30	50	70	90	110	130	150	170	190	210	230
11	31	51	71	91	111	131	151	171	191	211	231
12	32	52	72	92	112	132	152	172	192	212	232
13	33	53	73	93	113	133	153	173	193	213	233
14	34	54	74	94	114	134	154	174	194	214	234
15	35	55	75	95	115	135	155	175	195	215	235
16	36	56	76	96	116	136	156	176	196	216	236
17	37	57	77	97	117	137	157	177	197	217	237
18	38	58	78	98	118	138	158	178	198	218	238
19	39	59	79	99	119	139	159	179	199	219	239
20	40	60	80	100	120	140	160	180	200	220	240

NAME

POSITION:

COMPANY:

PRODUCT MFG.:

STREET

CITY ZONE STATE

Do not use after 10-15-58

NEW PRODUCTS

300	305	310	315	320	325	330	335
301	306	311	316	321	326	331	336
302	307	312	317	322	327	332	337
303	308	313	318	323	328	333	338
304	309	314	319	324	329	334	339

FREE LITERATURE

400	405	410	415	420	425	430	435
401	406	411	416	421	426	431	436
402	407	412	417	422	427	432	437
403	408	413	418	423	428	433	438
404	409	414	419	424	429	434	439

AVIATION DATA

500	505	510	515	520	525	530	535
501	**506**	**511**	**516**	**521**	**526**	**531**	**536**
502	507	512	517	522	527	532	537
503	508	513	518	523	528	533	538
504	509	514	519	524	529	534	539

JULY, 1958 — Circle number to receive free information about any product described or advertised in this issue.

ADVERTISERS

1	21	41	61	81	101	121	141	161	181	201	221
2	22	42	62	82	102	122	142	162	182	202	222
3	23	43	63	83	103	123	143	163	183	203	223
4	24	44	64	84	104	124	144	164	184	204	224
5	25	45	65	85	105	125	145	165	185	205	225
6	26	46	66	86	106	126	146	166	186	206	226
7	27	47	67	87	107	127	147	167	187	207	227
8	28	48	68	88	108	128	148	168	188	208	228
9	29	49	69	89	109	129	149	169	189	209	229
10	30	50	70	90	110	130	150	170	190	210	230
11	31	51	71	91	111	131	151	171	191	211	231
12	32	52	72	92	112	132	152	172	192	212	232
13	33	53	73	93	113	133	153	173	193	213	233
14	34	54	74	94	114	134	154	174	194	214	234
15	35	55	75	95	115	135	155	175	195	215	235
16	36	56	76	96	116	136	156	176	196	216	236
17	37	57	77	97	117	137	157	177	197	217	237
18	38	58	78	98	118	138	158	178	198	218	238
19	39	59	79	99	119	139	159	179	199	219	239
20	40	60	80	100	120	140	160	180	200	220	240

NAME

POSITION:

COMPANY:

PRODUCT MFG.:

STREET

CITY ZONE STATE

Do not use after 10-15-58

NEW PRODUCTS

300	305	310	315	320	325	330	335
301	306	311	316	321	326	331	336
302	307	312	317	322	327	332	337
303	308	313	318	323	328	333	338
304	309	314	319	324	329	334	339

FREE LITERATURE

400	405	410	415	420	425	430	435
401	406	411	416	421	426	431	436
402	407	412	417	422	427	432	437
403	408	413	418	423	428	433	438
404	409	414	419	424	429	434	439

AVIATION DATA

500	505	510	515	520	525	530	535
501	**506**	**511**	**516**	**521**	**526**	**531**	**536**
502	507	512	517	522	527	532	537
503	508	513	518	523	528	533	538
504	509	514	519	524	529	534	539

FOR AIRCRAFT AND MISSILE APPLICATIONS:

Postage will be PAID by addressee

No postage stamp necessary if mailed in the United States

BUSINESS REPLY CARD First Class Permit No. 8066, Cleveland, O.

POSTAGE WILL BE PAID BY:

APPLIED HYDRAULICS

812 Huron Road

Cleveland 15, Ohio

Postage will be PAID by addressee

No postage stamp necessary if mailed in the United States

BUSINESS REPLY CARD First Class Permit No. 8066, Cleveland, O.

POSTAGE WILL BE PAID BY:

APPLIED HYDRAULICS

812 Huron Road

Cleveland 15, Ohio

Postage will be PAID by addressee

No postage stamp necessary if mailed in the United States

BUSINESS REPLY CARD First Class Permit No. 8066, Cleveland, O.

POSTAGE WILL BE PAID BY:

APPLIED HYDRAULICS

812 Huron Road

Cleveland 15, Ohio

USE ONE OF THESE TIME-SAVER CARDS...

...for more information on advertised products, new components, useful literature, etc. Just circle item number and drop in the mail.

Index to NEW PRODUCTS, USEFUL LITERATURE and AVIATION COMPONENT DATA

By Item Numbers

O-RING REFERENCE TABLES 403
E. F. Houghton & Co.
BLADDER TYPE ACCUMULATORS 404
Greer Hydraulics Inc.
INTERCHANGEABLE CYLINDERS 405
The Sheffer Corp.
SYSTEMS AND UNITS 406
General Regulators Corp.
BRASS FITTINGS 407
Span Brass Mfg. Co., Inc.
AIR COMPRESSORS 408
Schramm Inc.
HYDRAULIC FILTERS 408
Alsop Engr. Co.
VERTICAL 5-PLUNGER PUMPS 409
Ajax Iron Works
HYDRAULIC CYLINDERS 410
Miller Fluid Power
HIGH PRESSURE HOSE ASSEMBLIES 411
Eastman Mfg. Co.
HIGH PRESSURE COMPRESSORS 412
Joy Mfg. Co.
TRANSMISSION APPLICATIONS 413
The Oilgear Co.
VALVE STOCK LIST 414
Automatic Switch Co.
HYDRAULIC 4-WAY AND FLOW CONTROLS 415
Denison Engr. Div.
CLEANER, COOLER, DRYER AIR 418
Jos. A. Murphy Co.
ADVANTAGES OF TEFLON 419
Chicago Rawhide Co.
BRONZE PUMPS 420
Tuthill Pump Co.
RELIEF VALVE GUIDE 421
Fluid Controls Inc.
DRY BEARING MATERIAL 422
United States Gasket Co.

Aviation Component Data

Descriptions start on page 110

PRESSURE REDUCER 500
Vinson Mfg. Co.
QUICK DISCONNECT COUPLINGS ... 501
Parker-Hannifin
BRAKE VALVE 502
Tactair Valve Div.
SOLENOID VALVE 503
M. C. Mfg. Co.
ELECTRO-HYDRAULIC SERVO VALVE 504
Pesco Products Co.
PLASTIC SEAL 505
Rocketdyne Div.
TIME DELAY RELAYS 506
Temco Instrument Co.
SERVO VALVES 507
Lear Inc.
INTERVAL TIMER 508
Western Design & Mfg. Corp.

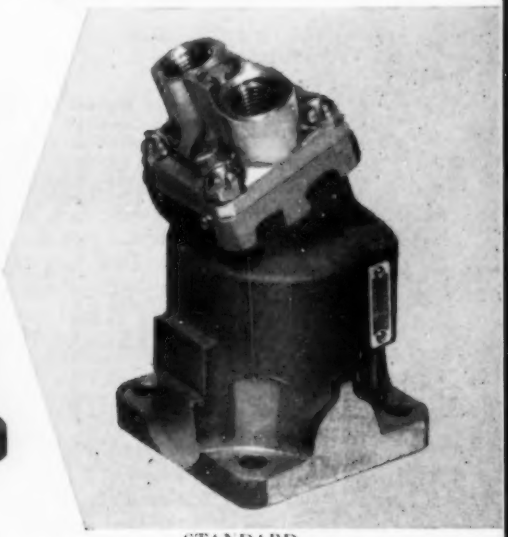
FOR AIRCRAFT AND MISSILE APPLICATIONS:

Variable Pump Design Breakthrough!

...by VICKERS

Variable hydraulic output from constant displacement package

NEW MINIATURIZED
VARIABLE DISPLACEMENT
3906 Series ■ Weight...2.4 lb



STANDARD
CONSTANT DISPLACEMENT
3906 Series ■ Weight...2.1 lb

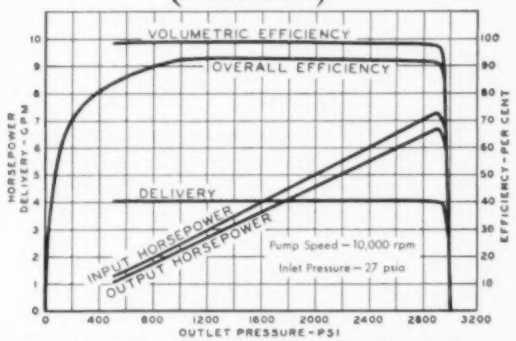
- 48% weight reduction—70% smaller envelope*
- 12,000 rpm for aircraft applications
- 18,000 rpm for missile use
- 24,000 rpm for intermittent duty
- 9.7 gpm delivery at 24,000 rpm
- 17 hp (over 7 hp/lb) at 24,000 rpm and 3000 psi
- 98% volumetric efficiency—92% overall efficiency
- Uses proven Vickers 3000 psi rotating pumping element
- Integral automatic pressure compensator
- Extremely rapid response
- Minimum external sealing elements
- Minimum number of moving parts*
- Broad range of control methods available
- First of a new complete line
- Power saving (and heat rejection) advantages of variable displacement at fixed displacement weight and envelope.

*Compared to standard 3000 psi Vickers Series PV-3906 variable displacement axial piston pump.

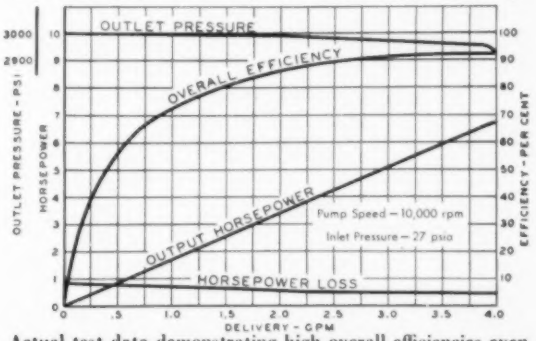
For further information write for Bulletin No. A-5233.

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Aero Hydraulics Division
Engineering, Sales and Service Offices:
ADMINISTRATIVE and ENGINEERING CENTER
Department 1474 • Detroit 32, Michigan
TORRANCE, CALIFORNIA • 3201 Lomita Boulevard
P.O. Box 2003 • Torrance, California

Performance Characteristics of Model E-0011111 Pump
(PV-3906 -30° Size)



Curves above show actual performance of new Vickers variable delivery pump. Note exceptionally high volumetric and overall efficiencies throughout broad outlet pressure range.



Actual test data demonstrating high overall efficiencies even at partial flows for the new Vickers variable delivery pump. Note low horsepower loss throughout entire delivery range.

where U_H = hoop tension, in.-lb,
p = pressure in the barrel, psi, (external load ÷ piston area)
d = barrel ID, in.,
L = effective length, in.,
D = mean barrel diameter, in.,
t = barrel thickness, in.

End cap bending is gotten from

$$U = \frac{x^3}{12\,EI} \qquad (8)$$

where x = one-half the span of a simple support beam, in. This is idealized for simplicity. In practice, specific conditions determine the best equivalent.
E = modulus of elasticity, lb/sq in.,
I = moment of inertia, in.^{4}

• **Example**—To show how the method is used, spring constant for the cylinder shown in Figure 2 will be calculated. First step is calculation of the axial strain energy in the piston rod, Figure 3. It is assumed that the rod is mild steel with a modulus of elasticity, E, of 29 x 10^6 psi. Then, from Formula 6

$$U = \frac{1.0^2 \times 10}{2 \times \pi/4(1.0^2 - .68^2)(29 \times 10^6)} = .408 \times 10^{-6} \text{ in.-lb}$$

It is assumed here and in the following calculations that there is unit load of 1 lb. This simplifies the calculations and makes it easy to find elongation for any total load after the total spring constant is found.

Next, from Formula 7, hoop tension for the barrel, see Figure 4, is found. The barrel is assumed to be aluminum with a modulus of elasticity of 10.3 x 10^6 psi.

$$U_H = \frac{(.314^2)(2.25^2)(6.2)(\pi)(2.39)}{8(.14)(10.3 \times 10^6)} = 2 \times 10^{-6} \text{ in.-lb}$$

and axial strain energy in the barrel, from Formula 6, is

$$U = \frac{1.0^2(6.2)}{2(\pi/4)(2.53^2 - 2.25^2)(10.3 \times 10^6)} = .286 \times 10^{-6} \text{ in.-lb}$$

Strain energy for the end cap, from Formula 8, is

$$U = \frac{1.0^3}{12(10.3 \times 10^6)(.0167)} = .485 \times 10^{-6} \text{ in.-lb}$$

The end cap, shown in Figure 5, is of the same material as the cylinder barrel.

Formula 3 is now used to find the total spring constant.

$$K_c = \frac{1.0}{2(.408 + 2 + .286 + .485)10^{-6}} = 157{,}000 \text{ lb/in.}$$

This answer assumes that the fluid is incompressible. Assuming the fluid is MIL-O-5606 at 70 F, and bulk modulus is, therefore, 250,000 psi, K_f is found with Formula 5.

$$K_f = \frac{250{,}000(2.25^2)}{\pi 2.25^2/4(6.2)} = .1595 \times 10^6 \text{ lb/in.}$$

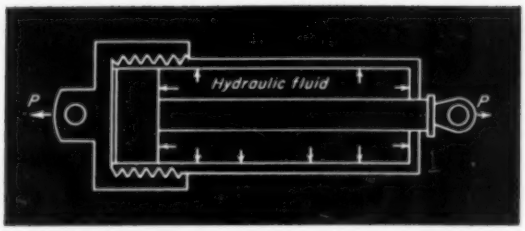


FIG. 2. CYLINDER for which the sample calculations in this article are performed.

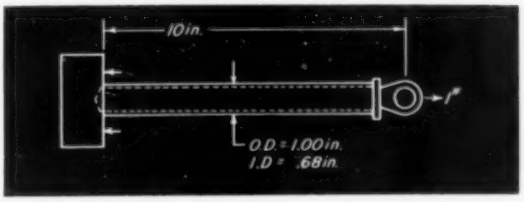


FIG. 3. PISTON ROD and piston of the example.

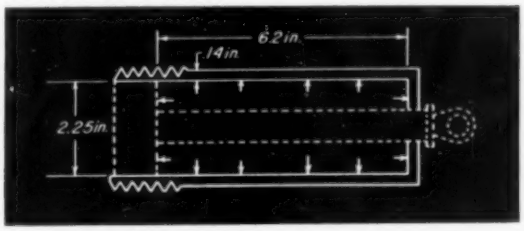


FIG. 4. CYLINDER BARREL dimensions.

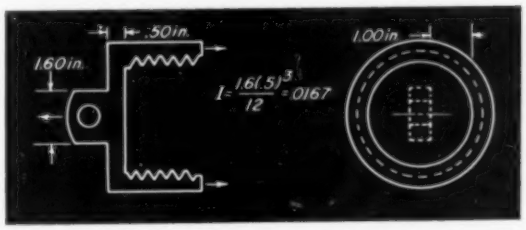


FIG. 5. THE END CAP for the cylinder in the example.

With this value and the total spring constant for the actuator, overall spring constant for cylinder and fluid can be found from Formula 4.

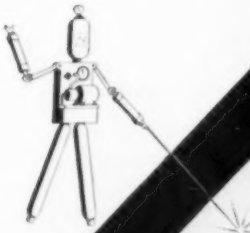
$$K_T = \frac{157{,}000 \times 159{,}500}{157{,}000 + 159{,}500} = 79{,}000 \text{ lb/in.}$$

As this shows, the effect of bulk modulus of the fluid on the total spring constant is quite important. In this case it almost halves the spring constant to be used.

To complete the example, let's assume that air load might be 10,000 lb applied to the piston rod in tension. Then to prevent the flap from being drawn away from a flush position, cylinder stroke on closing would have to be increased by 10,000 lb/ 79,000 lb/in., or .127 in. ▼▼▼

GREER ACCUMULATORS ...NOW NATION-WIDE SALES AND SERVICE

PROOF OF EXTRA SERVICE...



U. S. Patents under Olaer Licenses

New!

GREER PRECISION THROTTLING VALVES WITH INTERCHANGEABLE PORT FLANGES

A proven and exclusive valve line available in 6 line sizes up to 2". Greer's universal design concept provides maximum flexibility and standardization for virtually all hydraulic systems. Cuts installation, maintenance, spare parts and other costs.

Write for descriptive Greer Brochure TV-12

THE GREER NETWORK OF SALES OFFICES AND REPRESENTATIVES is now located in cities from coast-to-coast, and is expanded with the addition of a new west coast sales, service and manufacturing facility.

All Greer representatives are specialists in the field of fluid mechanics, and provide know-how and experience in the application of Greer Accumulators and hydraulic components to modern machinery and equipment. Greer distributors and sales offices carry a complete inventory of accumulators and spare parts for prompt, on-the-spot sales and service.

For immediate assistance with any hydraulic problem, your Greer representative is *the man* to contact. Call or write today without obligation.

Distributors & Representatives: **ATLANTA,** J.A. Postell • **BUFFALO,** Tri-Line Corp. • **CLEVELAND,** The Paquin Co. **DAYTON,** The Paquin Co. • **PHILADELPHIA,** The Maleson Co. • **PITTSBURGH,** Weiman Pump & Supply Co.

"Foremost in Fluid Mechanics"

GREER HYDRAULICS INC. • N. Y. INTERNATIONAL AIRPORT • JAMAICA 30, NEW YORK

Sales Offices: **CHICAGO,** 1908 W. Cermak Rd. • **DAYTON,** 25 S. Main St. • **DETROIT,** 21315 Woodward Ave. • **DALLAS,** P.O. Box 11506

Subsidiary: **GREER HYDRAULICS ENGINEERING CORP.** • 4474 East Olympic Boulevard, Los Angeles 23, California

AVIATION NEWS

from the fluid power field

Vickers Inc., has made two appointments at its Torrance, Calif. plant. **Walter K. Deacon** was made chief engineer of the Aero Hydraulic Division and **Donald J. O'Rourke** was named sales application engineer. Deacon had been eight years with McCulloch Motors Corp., where

Donald J. O'Rourke
Aero Hydraulics
Vickers Inc.

Walter K. Deacon
Aero Hydraulics
Vickers Inc.

he was chief engineer and manager of new products development. Mr. O'Rourke had been with Saginaw Steering Gear Division, General Motors Corp., where he was senior power steering designer, and senior sales engineer of the aircraft actuator section.

PEAR-SHAPED . . .

container in the engine pod of this Boeing KC 135 jet tanker is a specially designed air storage tank for the engine starting system. Special shape was dictated by space available in the pod. Made by Walter Kidde & Co. Inc., the tank holds 2950 cu. in., meets gunfire resistance requirements of MIL-C-7905 and weighs 84 lb. Pressure rating is 3000 psi; proof pressure is 5000 psi.

Robert E. Kemelhor has been named manager of future product planning and development for both **Pesco Products** and **Wooster Division of Borg-Warner Corp.** Prior to his appointment he had spent five years as chief engineer for McLean Development Lab., Inc., Long Island, N. Y. According to R. A. Powley, president and general manager of the two divisions, the new job was established to speed up new developments to meet the expanding missile programs.

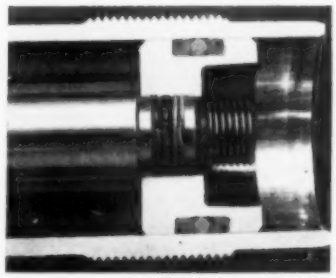
Hydrodyne Corp., announced the appointment of **G. S. Massa** as a member of the board of directors and vice president in charge of operations of that firm. Mr. Massa has been active in aircraft engineering on the west coast for many years.

Bendix-Aviation Corp. announced that sale of components and systems for missiles will account for 54.4 percent of their 1958 sales. The division's hydraulic systems and components are used to provide power for flight control surfaces in response to electronic signals from the guidance system.

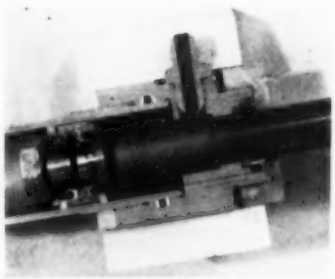
Skyvalve, Inc., a newly formed subsidiary of **Engelberg, Inc.,** Syracuse, N. Y., will specialize in the engineering, development, and manufacture of high pressure air and hydraulic valves for missiles and rockets. **John T. Schenck** has been named president and **Robert L. Schaller** vice president.

Two new inventions . . . for sealing high-pressure high-temperature aircraft hydraulic systems have been made by *North American Aviation's Los Angeles division.* Developed for powerful hydraulic systems of futuristic planes and missiles which will operate at 3000 to 4000 psi at temperatures from —65 to above 500 F.

One is a back-up ring designed to be used with standard elastomertic packaging rings. It has been tested in an airplane landing gear fairing door cylinder through 100,000 cycles under conditions equal to 3000 psi and 450 F.



Back-up ring



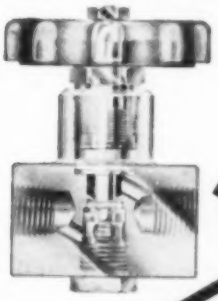
Metallic seal

The second invention is a new approach to the metallic sealing of systems operating above 4000 psi at temperatures of —65 to 750 F.

CIRCLE 62 ON TIME-SAVER CARD

NEW MODEL 949T MANUAL SHUT-OFF VALVE

...for superior valve leakage control by Circle Seal



CIRCLE SEAL

...easier operation with threads out of fluid stream, reduced operating torque...increased handle finger or detent depth and flow passages...for high or low pressure gas service...rated at 0-5000 psi

COMPLETE ENGINEERING DATA AVAILABLE

JAMES, POND AND CLARK INCORPORATED
2181 East Foothill Boulevard, Pasadena, California
REPRESENTATIVES IN ALL PRINCIPAL CITIES

S See Our Catalog in Sweet's Product Design File

First choice of the rocket and missile industry...

Three superlative Marsh products are widely used and approved by the aircraft and missile industry:

MARSH Pressure Gauges...
because they combine the most advanced features ever found in pressure, vacuum and compound gauges. There is a Marsh Gauge for every conceivable application.

MARSH Needle Throttling Valves...
because they are guaranteed to give micrometer regulation at HIGH pressures—pressure up to 10,000 psi—and any temperature up to 500° F.

MARSH Dial Thermometers...
because they offer the precision and accuracy a precision industry demands. Most complete line; wide temperature ranges, dial sizes, patterns, finishes.

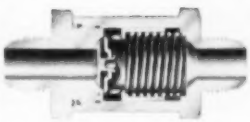
All Marsh products available with AND threads

MARSH *New catalog covers all details*

MARSH INSTRUMENT CO. *Sales Affiliate of Jas. P. Marsh Corp.* **Dept. 19, Skokie, Ill.**
Marsh Instrument & Valve Co., (Canada) Ltd., 8407 103rd St., Edmonton, Alberta, Canada. Houston Branch Plant, 1121 Rothwell St., Sect. 15, Houston, Texas

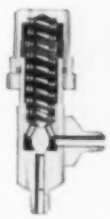
ground support and test equipment

REPUBLIC VALVES



FREE-FLOW CHECK VALVES
No leakage. 3000 psi. Very low pressure drop. Can be furnished to open at ¼ to 35 psi. Brass, stainless steel, or aluminum alloy. ⅛" to 2" pipe or tube. Temp. range -65° to 200°F.

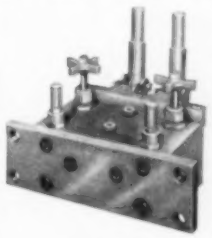
RELIEF VALVES
Quick unloading, smooth operation. Guided shut-off piston with stainless steel or Nylon seat. Pressure range to 4000 psi. Brass, aluminum alloy, or stainless steel. ⅛" to ¾" pipe or tube. Temp. range to 400°F.



HAND PUMP
For hydraulic applications on missile carrier and support equipment. Double-acting. 2 cu. in. displacement per cycle. 1000 psi. working pressure. Aluminum alloy body, stainless steel trim. -65° to 160°F.

LEVELATOR VALVE
For automatically maintaining height and level condition in any vehicle with air spring suspension. Controls swaying in transit, and off-level position while standing. Applicable to trucks, buses, trailers, carriers, cranes, etc.

LO-TORQ SELECTOR VALVES
Smooth, easy operation, with low turning torque because of pressure balancing design. 0 to 6000 psi. Bronze, steel, or aluminum alloy. ⅛" to 2" pipe or tube. 2, 3, 4 ports.



DUAL HAND PUMP
2 pumps, 2 relief valves, and 2 needle shut-off valves, compactly manifolded for elevating mechanisms, hydraulic applications on ground support equipment, etc. Aluminum alloy body, stainless steel trim. -65° to 160°F.

Distributors in principal cities coast to coast

RM **REPUBLIC MANUFACTURING CO.**
15655 BROOKPARK ROAD • CLEVELAND 35, OHIO

CIRCLE 74 ON TIME-SAVER CARD

CIRCLE 98 ON TIME-SAVER CARD

AVIATION COMPONENT DATA

Pressure Reducer

. . . and relief valve

Compact and light this valve regulates hydraulic or pneumatic pressures from 3000 psi down to

1500 psi and will flow 1.8 gpm. The unit is 3.25 in. by 1.75 in. and weighs .19 lb. It was designed for hydraulic surface controls on missiles.—*Vinson Mfg. Co., Van Nuys, Calif.*

CIRCLE 500 ON TIME-SAVER CARD

Quick Disconnect Couplings

. . . for high pressure

Couplings were designed to meet the requirements of Type II hydraulic systems with working pressures to 3000 psi and flows of 1.2 to 45 gpm. The coupling is com-

posed of a socket and a nipple. The socket is attached to flexible hose or coiled tubing and the nipple is mounted on a bulkhead or some other fixed member. The coupling features two springs in loading the lock so that if one fails the other will carry the load.

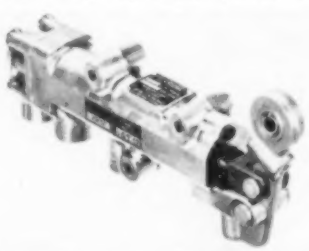
The locking is done by 4 "ears" that extend out from the lock in the direction of the nipple. These ears fit into slots in the nipple assembly. When the sleeve is engaged as far forward as it will go, the ears have rotated because of a helical thread, so that they will mate into these slots. To disconnect the coupling, the lock must be moved away from the nipple assembly.—*Parker Aircraft Co., Division of Parker-Hannifin Corp., Los Angeles, Calif.*

CIRCLE 501 ON TIME-SAVER CARD

Brake Valve

. . . for air or oil

Known as model 9904 this valve was designed for aircraft brake control using hydraulic power for



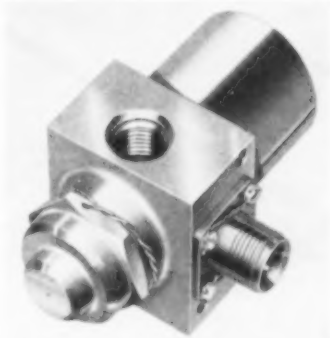
normal service and air for emergency. Made for 3000 psi service it features accurate feel in application and release of pressure, fast pressure response, low pressure drop, low leakage and smooth control of brake pressures without hunting or surging. Forged aluminum housing, weight 1¼ lb, temperature range —65 to 160 F.—*Tactair Valve Div., Aircraft Products Co., Bridgeport, Pa.*

CIRCLE 502 ON TIME-SAVER CARD

Solenoid Valve

. . . is fast acting

Developed for use in air or nitrogen systems in aircraft and missiles, the valve weighs 1.1 lb. It is normally closed and has a temperature range of — 65 to 165 deg



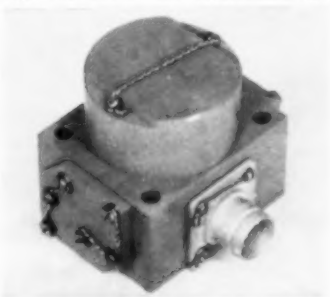
F. Operating pressure is 200 psi and internal leakage from the valve is 4 cc per hr. Actuating time, either open or closed, is 70 milliseconds. Designed to meet all military standards.—*M. C. Manufacturing Co., Lake Orion, Mich.*

CIRCLE 503 ON TIME-SAVER CARD

Electro-hydraulic Servo Valve

. . . gives fast response

Output flow is directly proportional to the electrical input. Flow type feedback control permits large



power spool overlap, allowing greater clearances and reduced cost. Total weight of the valve is 11 oz and it will operate from —65 to

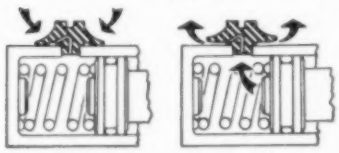
450 F. It consists of a dry coil torque motor, a hydraulically balanced flapper pilot valve, a 4-way slide type power valve, and a flowmeter feedback loop. Valve has flow rates to 7 gpm.—*Pesco Products Div., Borg Warner Corp., Bedford, Ohio.*

CIRCLE 504 ON TIME-SAVER CARD

Plastic Seal

. . . vents hydraulic system

A small seal, about the size of your thumb nail, permits air or



CLOSED VENTING ACTION

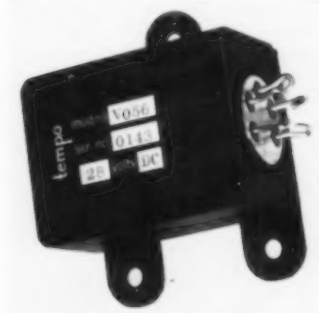
gas to escape from a system without allowing any contaminants to be sucked in. It consists of small plastic mushroom shaped valve with an internal port covered by the lip of the mushroom. Vented air lifts the lip allowing it to escape. When no air is escaping the lip seals off the system.—*Rocketdyne a Division of North American Aviation Inc., Canoga Park, Calif.*

CIRCLE 505 ON TIME-SAVER CARD

Time Delay Relays

. . . save weight with transistors

Time delays from .01 to 60 sec between application of current, and



relay contact pull-in, are possible with this 5½-oz relay. Contacts may be single-pole, double-throw or 3-pole, double-throw, with a 10-amp resistive load. Contact life is a minimum of 100,000 cycles at rated load, and accuracy is ±10% of delay period.—*Tempo Instrument Inc., Hicksville, N. Y.*

CIRCLE 506 ON TIME-SAVER CARD

Continued on next page

2nd printing now available

AIRCRAFT HYDRAULIC DESIGN

• **The first book** dealing with hydraulic component and system design for high-speed piloted aircraft and missiles, has been written by a leading aircraft engineer. Developed from practical and theoretical material, the book develops many basic equations including those relating pressure gradient, flow-path dimensions, flow rate, velocity, fluid density, and viscosity.

$4.50

10 or more $4.00 per copy

The Industrial Publishing Corporation

812 Huron Road Cleveland 15, Ohio

WHICH SEAL WILL SOLVE YOUR PROBLEM?

Seals drawn to same scale.				
Type of Seal	**Standard**	**Modified**	**Bellows**	**Shaft Surface**
Pressure (PSI)	1000	500	250	75
Speed (FPM)	15,000	15,000	15,000	15,000
Temperature (°F)	350° to 450°	−360° to 350°	−360° to 700°	500° to 700°
Uses	Fluids including aviation fuel, synthetic lubricants, etc.	Rocket motors, HNO_3, H_2O_2, NPN, LOX, Ethylene Oxide	Applications calling for all-metal, high temperature sealing	Sealing gaseous mediums in a minimum amount of axial space
Send for	Bull. #7	Specially enginered	Bull. #18	Bull. #19

CAUTION: Maximum conditions indicated for each type do not necessarily imply that all are available in a single seal. Sealol engineers will gladly recommend the seal best suited to the operating conditions of your particular application. Write today . . . no obligation, of course!

SEALOL CORP
157 Post Rd., Providence 5, R. I.

SEALOL

TO SOLVE YOUR HIGH TEMPERATURE PROBLEMS

We offer a Diversified Line of molded products . . . and a complete Custom Engineering Service with the experience and know-how to develop correctly designed, accurately manufactured products that will meet the most rigid military, governmental or commercial specifications.

HIGH TEMPERATURE DIAPHRAGMS—in a wide range of synthetic and natural materials for operation from -100°F to 500°F.

STAINLESS STEEL CLAD GASKETS—are available with linings of Fiberfrax, asbestos, Teflon and other synthetic materials, for temperatures of 2000°F.

FRICTIONLESS CLAMPS—with Teflon and asbestos linings will not wear. Retain their clamping action under extreme conditions of vibration.

Send us your specifications, and we will provide specific recommendations. ***Write today for your free copy of our catalog describing our products and services.***

GASKETS • STAINLESS STEEL CLAD GASKETS • DIAPHRAGMS
HIGH TEMPERATURE CLAMPS • MOLDED RUBBER PARTS • METAL STAMPINGS
METAL-TO-RUBBER BONDING

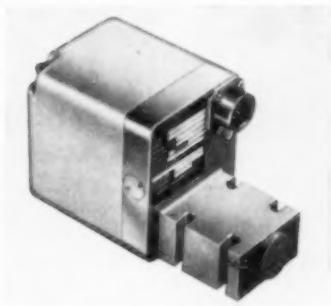
THE
AERO GASKET
CORPORATION
770 Hanover Street, Meriden, Connecticut

CIRCLE 4 ON TIME-SAVER CARD

AVIATION COMPONENT DATA

Servo Valves
. . . are electro-hydraulic

The simplified direct drive and dry torque motor design of these single stage valves gives reliable control with flows to 1 gpm, and



pressures to 3000 psi. They have a natural frequency of 350 cps and a 90 deg phase lag occurs at 300 cps. Internal leakage is less than 15 cipm, temperature range —65 to 180 F.—*Lear Inc., Lear-Romec Div., Elyria, Ohio.*

CIRCLE 507 ON TIME-SAVER CARD

Interval Timer
. . . has low contact bounce

Timing cycles may be as short as 1 sec or as long as several hours. Contact bounce on this fixed-position, 5-channel timer is within a range of 50 to 300 microseconds. Contacts are designed for a load

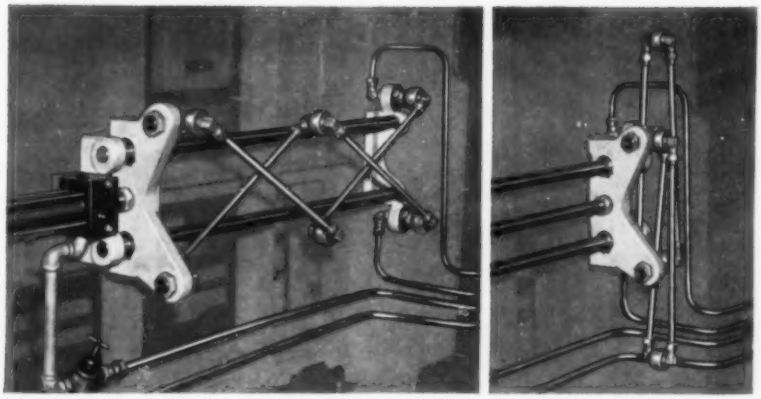
current of at least .5 amp and will operate on higher current depending on the type of circuits and the duty cycle required. The tolerance of the timing pulse is ±1/5 of one percent or ±10 milliseconds whichever is greater. Size is 5 in. long and 2.2 in. dia; weight is 1.5 lb.—*Western Design & Mfg. Corp., Santa Barbara, Calif.*

CIRCLE 508 ON TIME-SAVER CARD

IN EQUIPMENT DESIGN ■

CHIKSAN SWIVEL JOINTS

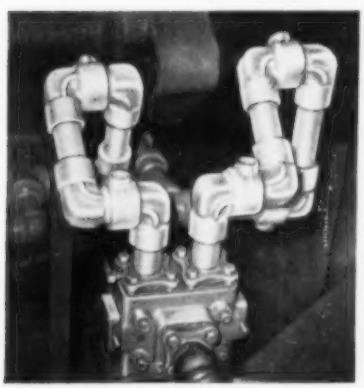
SMOOTH OUT KNOTTY LINE PROBLEMS



STEEL LINES FOLD LIKE AN ACCORDION

Connected to a moving head, these compact swivel jointed all-metal hydraulic lines flex and fold like an accordion on this automatic bottle unpacking machine.

When a machine's moving parts cause tight bend or twist on hose lines, Chiksan Swivel Joints provide a ready solution. When design dictates the use of metal lines, Chiksan Swivel Joints allow rubber-like flexibility. In fact, wherever line flexibility is required, designers and maintenance engineers know it's just good business to call on Chiksan. Precision made Chiksan Swivel Joints with their infinite service life, full 360° rotation and high safety factor, quickly pay for themselves by minimizing hose replacement and eliminating costly line failure, fluid loss and downtime. If your equipment hose lines require frequent replacement due to torsion or bend radii fatigue, or if flexible all metal lines are in order, contact Chiksan. A nearby representative will call, analyze your requirements, and make specific recommendations. Write today for his name.

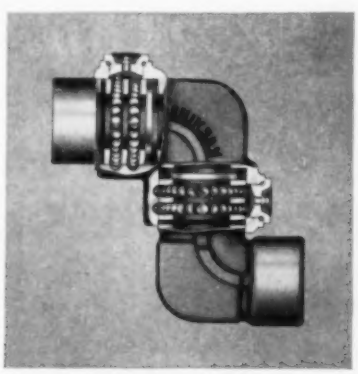


NO HOSE BURST HERE

These Chiksan swivel jointed steel lines on a die casting machine eliminate damaging hose ruptures, reduce fire hazard, fluid loss and setup time by 75%.

NO BEND FATIGUE HERE

This highly specialized lens grinder utilizes Chiksan Swivel Joints to eliminate tight hose bend as the multiposition head is shifted from one grinding position to another.



LOOK INSIDE A SWIVEL JOINT

Detailed attention to detail. Precision machining and specific packing seals for specific services. These are the quality-plus features built into every Chiksan Swivel Joint.

CHIKSAN

fmc A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

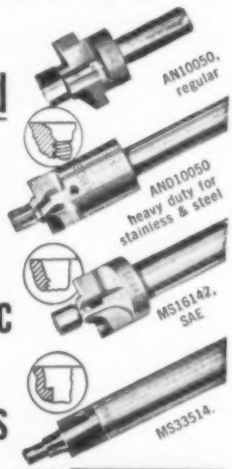
CHIKSAN COMPANY–BREA, CALIFORNIA • CHICAGO 5, ILLINOIS • NEWARK 2, NEW JERSEY

Well Equipment Mfg. Corp. (Division), Houston 1, Texas • Subsidiaries: Chiksan Export Company • Chiksan of Canada, Ltd.

CIRCLE 107 ON TIME-SAVER CARD

WHY BUY SPECIALS?

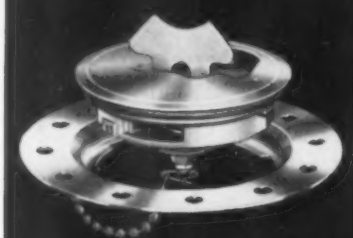
Use standard cutters for popular hydraulic port contours



One pass completes all operations necessary to produce the port contour. Job time cut as much as ⅔! All have carbide cutting edges for long life, smooth finishes. Available in all sizes. Write for prices.

SONNET
Tool and Mfg. Co.
576 North Prairie Avenue
Hawthorne
California

GABB
FC-3500



TANK FILLER CAP

The Model FC-3500 is the first tank filler cap to successfully pass all test requirements of MIL-C-7244B (ASG) applicable to fuel, oil, alcohol-water and hydraulic reservoirs.
Lever action design permits cap to be opened safely under pressure and removed completely with only a 35° turn. Now available in 1.5, 2, 3, and 3.82" openings.

Write for free literature.

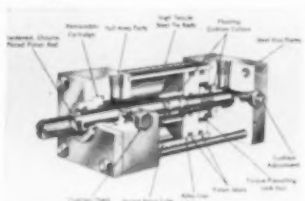
GABB SPECIAL PRODUCTS Inc.
WINDSOR LOCKS, CONN.

NEW PRODUCTS

AIR AND OIL CYLINDERS
. . . have floating cushions

Designation: Series A

Features: Cushions are fully adjustable and self-centering. Both cushion check and cushion adjustment are interchangeable. They are made in 21 standard models. Rod cartridge is removable for repacking.



Construction: Cylinder barrels are honed brass and end plates are steel. Pistons are alloy iron with block-vee seals for temperatures from —20 to 150 F. Bore sizes 1½ to 14-inch and strokes to customer requirements.

S-P Mfg. Corp.
Solon, Ohio

CIRCLE 310 ON TIME-SAVER CARD

OIL FILTERS
. . . with interchangeable elements

Designation: Flo-Pac 5 and Type K

Features: The Flo-Pac 5 is made of resin-impregnated pleated paper and has 6300 sq in filtering area. It will remove solids down to 5 micron and is recommended for water-base fluids. The Type K cartridge was made to meet JIC standards. It contains 13 lb of fullers

earth enclosed in a metal container. It removes water, acid, tars, and solids.

Both elements are interchangeable in the standard filter housing.

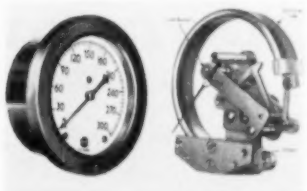
Commercial Filters Corp.
Melrose, Mass.

CIRCLE 311 ON TIME-SAVER CARD

PRESSURE GAGES
. . . give 1 per cent accuracy

Designation: A-line

Features: The new line fits in between the company's high accuracy



Supergage and the less costly drawn steel case models. The line meets ASA grade A standards with guaranteed accuracies within 1 per cent of scale range for the middle half of scale and 1½ per cent for the remainder.

Specifications: Bourdon tubes are made in phosphor bronze, 403 or 316 stainless steel, with female tip construction and flat tube design. Dial sizes to 12 in and pressures to 10,000 psi.

United States Gauge Division of
American Machine and Metals, Inc.
Sellersville, Pa.

CIRCLE 312 ON TIME-SAVER CARD

DIRECTIONAL VALVE
. . . has low internal leakage

Designation: VM-6506

Features: Designed for industrial and mobile service the valve is rated at 6000 psi working pressure. It uses a sliding plate which gives good metering and reduces internal leakage to about 1/5 that of a spool valve.

Specifications: Valve has a flow capacity of 6 to 10 gpm and can be stacked in 6 segments in a series. It is open center and has a built-in relief valve.

Dynex, Inc.
Division of Blackhawk Mfg. Co.
Pewaukee, Wis.

CIRCLE 313 ON TIME-SAVER CARD

Continued on page 116

air circuitry:

a new term of importance to control engineers.

Air has come of age as a control medium. No longer is it confined to the simple jobs of pushing a clamping device, moving a lever, or blowing chips. No longer is an air circuit just a valve, reservoir, and cylinder. Today the most complex of industrial control problems can and are being solved efficiently with air.

Today, pneumatic circuits can be interconnected. They can be set to control a complex sequence of operations *automatically*. They can be combined with electrical circuits. There is *no* control problem you have that can't be solved successfully with air.

The new role that pneumatic control can play in industrial operations demands a new way of thinking about air control. It demands a new way to describe control by air—a new name that suggests some of its limitless control possibilities. That's why Westinghouse Air Brake Company is now using the term "air circuitry" to describe the application of air control to automation.

Westinghouse Air Circuitry, we realize, has to be more than *just as good* as your present means of control. It has to offer you *extra advantages*. And it does.

Chief among these is its extreme simplicity. The devices themselves are uncomplicated mechanical devices. They have few moving parts. They are easy to service by any mechanic. The circuit connections are made with pipe—and what could be simpler than that!

This extreme simplicity brings with it other important "pluses" for air circuitry. The simple equipment is unusually reliable—there are few moving parts to wear out or get out of adjustment. The devices are sturdy and durable. They require very little maintenance. What maintenance there is can be handled without the services of highly trained technicians.

Above all, remember: no means of control is as *safe* as air.

Air circuitry can help you simplify your control problems. It can help you get accurate answers to your automation problems on any industrial machine . . . in any industrial process. And Westinghouse Air Brake Company can help you with the engineering of a suitable system. Westinghouse has been in the control engineering business for 80 years now. It has been at the forefront of the development and improvement of air control equipment and its applications.

For more information on Westinghouse Air Circuitry—how it has helped other companies, how it can help you—write for your copy of "Basic Pneumatic Control," or call our nearest sales office.

WESTINGHOUSE AIR BRAKE COMPANY, INDUSTRIAL PRODUCTS DIVISION, WILMERDING, PA.

CIRCLE 134 ON TIME-SAVER CARD

NEW PRODUCTS

HYDRAULIC CHECK
. . . gives smooth air cylinder speed

Designation: Model 3000

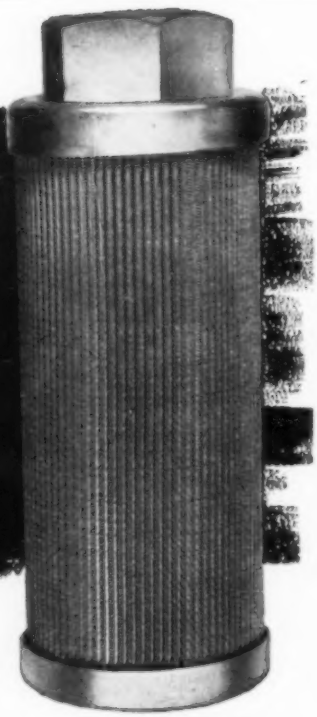
Operation: Check provides an adjustable opposed force to the movement of an air cylinder. Its main use is to control feed on machine tools. It consists of an oil-filled checking cylinder, a checking piston, adjustable metering valve, and a reservoir cylinder. Check is installed by connecting the cylinder to a fixed portion of the machine and the piston rod to the unit to be controlled. As the rod is pulled out, the piston in the checking cylinder forces oil through the metering valve and back into the opposite end of the checking cylinder. On the return stroke a one-way valve lets oil flow freely through the piston.

Appco Corp.
Olmsted Falls, Ohio
CIRCLE 314 ON TIME-SAVER CARD

Capital

HYDRAULIC OIL FILTER
with
Monel Metal Insert

Reservoir Type for Hydraulic and Oil Re-circulating Machinery



EASY TO INSTALL—EASY TO CLEAN
LONG LIFE—LOW COST—SIZES AND SCREENS TO FIT YOUR NEEDS

★ ONLY THREE PARTS
★ MEETS J.I.C. STANDARDS
★ GREATER FILTERING AREA
★ SPECIAL TRAP-WEAVE MESH

Specially woven MONEL wire cloth and a new method of compact corrugation, gives triple protection with less space than other filters of like capacity. Trap-weave mesh stops thin, elongated particles with NO loss of efficiency.

Non-corrosive, non-toxic materials throughout. Easily cleaned with an ordinary brush.

Write for descriptive circular.

CAPITAL ENGINEERING & MFG. CORP.
5836 SOUTH ASHLAND AVENUE, CHICAGO 36, ILLINOIS

AIR FILTER
. . . is easy to clean

Features: Designed for removing moisture, rust, and dirt particles from air lines they are simple in construction. Element can be removed for cleaning by removing the retainer ring which releases the bowl and element. A large petcock at the bottom is used for removing contaminates.

Gits Bros. Mfg. Co.
Chicago, Ill.
CIRCLE 315 ON TIME-SAVER CARD

HYDRAULIC PUMP
. . . gives more power in less space

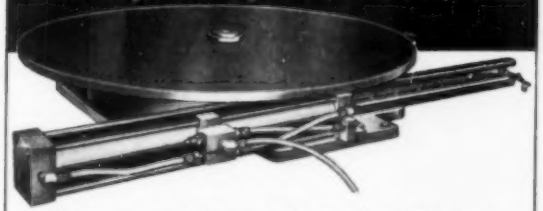
Features: Pump is vane type and features complete hydraulic balance to reduce bearing loads. At cranking speed vanes are retracted and the pump offers very little resistance. As the engine reaches its idle

Continued on page 118

CIRCLE 77 ON TIME-SAVER CARD

TURRETABLE

Cuts cost of feeding parts to drill, tap, mill, punch, assemble



New concept Pneumatic Feed—indexing pawl works on *rim* of turntable, for utmost accuracy! Tapered locating pin locks table precisely in *all directions;* remains locked at all times except when actually moving to next station, even if air pressure should fail.

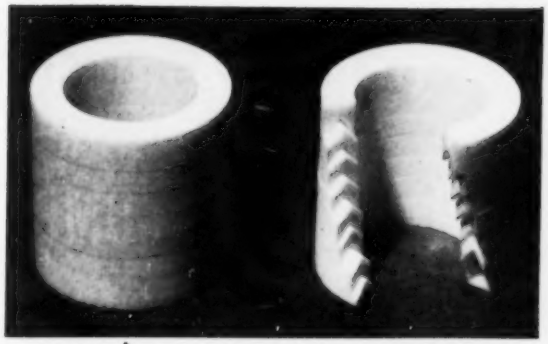
Fully described in Mead's complete catalog. Write today!

MEAD
SPECIALTIES COMPANY

4114 N. Knox Ave., Dept. AH-78 Chicago 41, Ill.

PATHFINDER IN AIR POWER AUTOMATION

CIRCLE 32 ON TIME-SAVER CARD



DORÉ V RINGS OF TEFLON* *are superior*

BECAUSE—

1. Uniform density, even out to the feather edge of the lip, insures proper, continuous pack-off, longer and better flex-life.
2. Rings are manufactured to close tolerances providing a tight seal with low gland pressure.
3. A special satin finish is added to give Doré "V" rings of Teflon an extremely low coefficient of friction.

In addition to V-Rings, Doré is molding Cup and Cone Packings, "U" Cup Packing, Piston Cups and Flange Packing of Teflon.

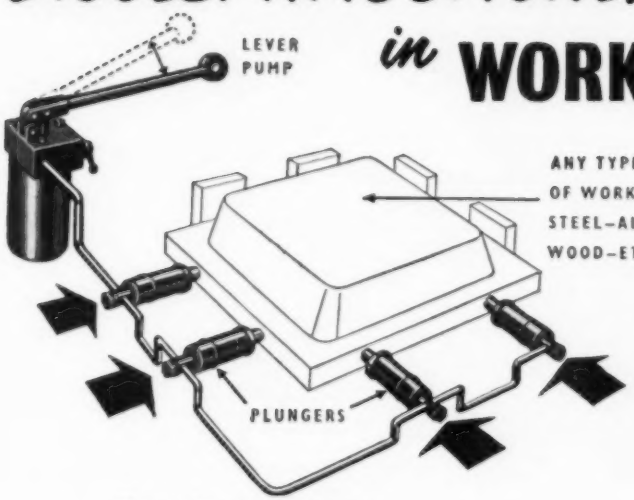
For Superior molded Teflon products, write for Doré Catalog.

* DuPont's registered trademark

John L. Doré Co.
5406 Schuler • P. O. Box 7772 • Houston 7, Texas
Export: 1505 Race St. • Philadelphia 2, Pa., U.S.A.
Cable Address: DOREX

SALES ENGINEERS FOR JOHN L. DORÉ, INC.
DU PONT'S TEFLON HI-QUALITY NYLON

BIGGEST TIME & MONEY SAVER *in* WORK CLAMPING



NEWTON TRADE PRODUCT MARK
Hydraulic
CLAMP SYSTEM

These plungers can exert a pressure of from 800lbs—4 tons.
Can be used in groups of any number.

Maximum pressure with smallest plungers
Easily adaptable to any fixture design
Simultaneous plunger action
Minimum floor to floor time.

Send today for illustrated brochure F/243

POWER JACKS *LIMITED*
MAYLANDS AVENUE · HEMEL HEMPSTEAD
ENGLAND · GRAMS: NEWSORBER, HEMEL HEMPSTEAD

CIRCLE 96 ON TIME-SAVER CARD

DARCOVA PUMCUPS

now available with

100% NYLON COMPOSITION

for HYDRAULIC CONTROLS, AIR CYLINDERS, RECIPROCATING PUMPS

Darcova Pumcup

Darcova 45° Bevel Type Pumcup

DARLING Pumcups—long noted for unequalled efficiency and life in all kinds of cylinders—are now greatly exceeding their own performance records! The new 100% Nylon Composition, available *only* in Darcova Pumcups, does it!

Nylon Pumcups are made in sizes, types and textures exactly right for your particular equipment—ready *now* to give you unprecedented piston packing performance!

Write for helpful data Bulletin No. 5503.

DARLING VALVE & MANUFACTURING CO.

Williamsport 15, Pa.

DARCOVA THE ORIGINAL COMPOSITION CUP

TRADE MARK PUMCUPS

NEW PRODUCTS

speed, centrifugal force and system pressure extend the vanes to start pumping action. Pump can be operated at speeds to 2000 rpm. Cartridge type construction permits replacement of the complete pumping assembly without removing the pump from its mounting.

Specifications: Capacity 25.2 gpm at 2000 psi and 2000 rpm. Overall envelope size is 4-5/8 x 5-3/4 x 5-3/8 in. Ports are SAE 4-bolt pad arrangement.

Vickers Inc.
Detroit, Mich.

CIRCLE 316 ON TIME-SAVER CARD

FOUR-WAY VALVES
. . . are subplate mounted

Designation: Series 6100

Features: Unrestricted passages to permit large flows, and smooth opening and closing of pistons. Extra long sealing surfaces to reduce leakage.

Specifications: Made in spring-offset, spring-centered and detent action. Sizes ¼ to 1½ inch. Pressures to 3000 psi. Seven standard spool types are available. The 1-inch valve is rated at 28.2 gpm at 15 ft per sec.

Rivett, Inc.
Boston, Mass.

CIRCLE 317 ON TIME-SAVER CARD

CUSHION VALVE
. . . stops air cylinder shock

Designation: LCV

Features: Valve is used in discharge line from the cylinder and is cam-actuated. It permits increased cycle speeds without in-

Continued on page 120

CIRCLE 110 ON TIME-SAVER CARD

CIRCLE 28 ON TIME-SAVER CARD

New
Engineering Handbook on

TEFLON*

Fully describes its advanced usage as a cushioning and insulating material for wire and tube supporting clamps.

Send now for your copy of this new 20-page illustrated "TX" Engineering Handbook on Teflon* (Tetrafluoroethylene). Contains all latest information on Teflon* including chemical, thermal, electrical and aging properties as well as modern methods of handling it. Illustrates seven models of Teflon* cushioned support clamps which are available in 18 standard types. Included is a comprehensive tabulated chart covering 28 tests, furnished courtesy of the Du Pont Company. Write today for free copy.

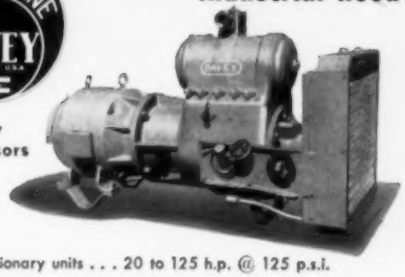
**Du Pont Company registered trademark.*

TA MFG. CORP.
4607 ALGER STREET • LOS ANGELES 39, CALIFORNIA

HYDROVANE DAVEY

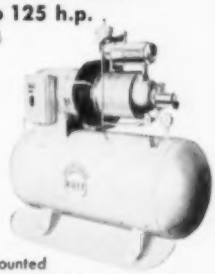
NEW... meets every industrial need!

Rotary Compressors



Stationary units . . . 20 to 125 h.p. @ 125 p.s.i.

- ✓ **Silent . . . vibrationless . . . compact**
- ✓ **Complete line . . . 2 to 125 h.p. . . . 8 to 500 c.f.m. @ 125 p.s.i.**
- ✓ **No complicated engineering . . . no compressor room . . . no foundation**
- ✓ **Easy to install and operate**
- ✓ **Air cooled or water cooled**



Tank mounted
2 to 5 h.p. @ 100-200 p.s.i.

Write for Bulletin M-132

INDUSTRIAL DIVISION

DAVEY pioneers of "air-cooled air."

DAVEY COMPRESSOR CO.
Kent, Ohio

Saves hours in piping installations

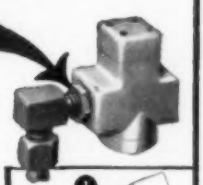
PAT. PENDING

Eliminates leaks in oil, air, water, vacuum, chemical lines

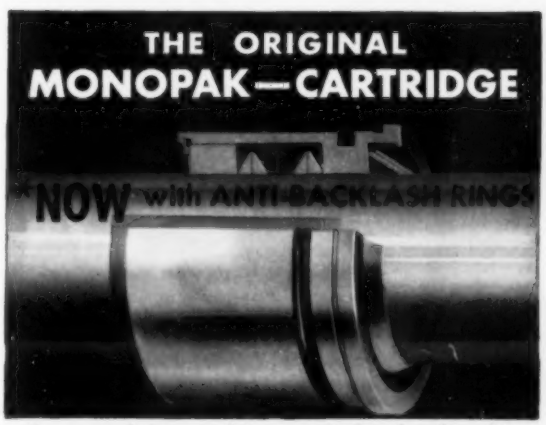
Tru-Seal saves hours in assembling piping installations because it enables you to run your pipe lines in any direction you wish, quickly and easily—without having to recut and re-thread piping sections. Wherever used on air, oil, water, steam, vacuum or chemical lines, it seals perfectly at —100° F. to plus 500° F.—*without the use of pipe dope.* Its installation requires only light tightening torque, thus eliminating over-tightening damage to valves, pumps, compressors, and other fittings.

For further information write

TRU-SEAL DIVISION
FLICK REEDY CORPORATION
2008 N. Hawthorne, Melrose Park, Ill.
"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.


1
Thread Tru-Seal on pipe or fitting as far as it will go hand tight.
SEAL SIDE
2
Thread pipe or fitting 3 threads into port. Point in desired direction.
3
Tighten Tru-Seal to complete leakproof assembly (only light torque required).

THE ORIGINAL MONOPAK—CARTRIDGE



A complete packing unit for hydraulic or pneumatic rods or cylinders.

*Detailed literature on request.

- **Easily installed or replaced.**
- **Needs no adjusting.**
- **Reduces initial machining expense.**
- **Longer service life.**
- **Includes "Seal-Guard" rod wiper.**
- **Low friction coefficient.**
- **Shock and burst proof.**
- **Cuts machine down-time.**

HYDRAULIC ACCESSORIES CO.
24301 Hoover Rd. Van Dyke, Mich.

NEW PRODUCTS

crease in shock and is easy to install on machinery.

Design: Valve stem is tapered and its position in the bore determines the amount of air discharged from the cylinder. A free return check lets air return to the cylinder at full pipe capacity. Position and length of cam controls piston acceleration and deceleration.

Specifications: They are made in ¼ to 1¼-inch pipe sizes. Valve body is cast bronze and internal parts are all corrosion resistant.

Numatics, Inc.
Highland, Mich.
CIRCLE 318 ON TIME-SAVER CARD

O-RINGS
. . . made with new process

Designation: MinJecto

Features: The new process is a refinement of injection molding and permits complete automation in producing O-rings. The process took three years to develop and will be used in the manufacture of sizes 1 to 27. They will be made of standard Buna N compound 366Y. The process permits the company to reduce its prices on standard O-rings.

Minnesota Rubber Co.
Minneapolis, Minn.
CIRCLE 319 ON TIME-SAVER CARD

PRESSURE REGULATORS
. . . have quick response

Designation: Series 20AP

Features: All internal parts are protected against corrosion. Made for water service, they give accurate

pressure control regardless of changes in primary pressure. Regulators are designed for large volume flows, and fast response to sudden demands.

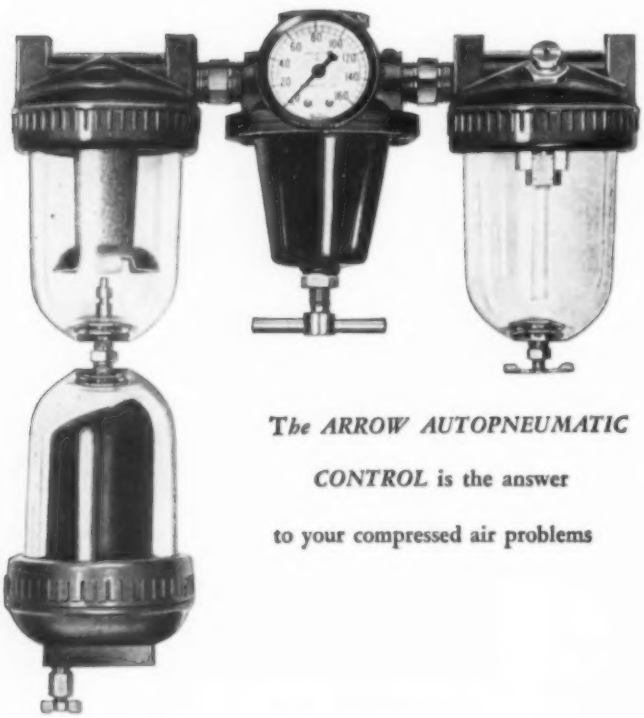
Specifications: Made in pipe sizes ¼ to 1-inch and pressure ranges 0 to 50 psi, 0 to 125 psi, and 0 to 250 psi. They are suitable for line pressures to 400 psi and temperatures to 200 F.

C. A. Norgren Co.
Englewood, Colorado
CIRCLE 320 ON TIME-SAVER CARD

NYLON FLARE NUTS
. . . won't shear plastic tubing

Features: They can be temperature cycled to 300 F without leaking and will not loosen with vibration. The nuts are designed

Continued on page 123



The ARROW AUTOPNEUMATIC CONTROL is the answer to your compressed air problems

Write for Free Catalog

ARROW TOOLS, INC.
1934 S. Kostner Ave.
Chicago 23, Illinois

CIRCLE 36 ON TIME-SAVER CARD

Small basic switch is low cost; directly interchangeable with AN3234 Specs

F2 SERIES

Series snap action switches are extra-compact with extremely high electrical capacity for their size. Mechanical and electrical life at 1/32" overtravel is 150,000 operations, minimum, with accurate repeatability and constant stability of tolerances. Self-aligning springs provide contact wiping action rare in a switch of this size.

Durable case of special plastic gives the switch an ambient temperature rating of −100° to +275° F. or +375° F. Available, *at low cost*, in three basic models with a wide selection of actuators.

SERIES F2 BASIC SWITCH: F2-3: Single Pole, Double Throw
F2-2: Single Pole, Normally Open; F2-1: Single Pole, Normally Closed

OPERATING CHARACTERISTICS

Electrical Rating: 10 AMP. 125/250 V. A.C. 60 cycles
30 V. D.C. inductive and resistive (6 AMP, 30 V. D.C. for Airborne Application)
Operating Force, 7 to 12 oz. — Movement Differential, .011 ± .005
Reset Force, 4 oz. Min. — Overtravel, 1/32 Min.
Pretravel, 3/64 Max.

WRITE FOR DETAILS IN DATA SHEET FF-7

ELECTRO SNAP

ELECTRO-SNAP
SWITCH & MFG. CO.

4224 West Lake Street
Chicago 24, Illinois

Rapid response, pilot-operated

PRESSURE CONTROLS

Relief, sequence and unloading valves to 5000 psi. Features exclusive control piston to minimize transient surge pressures in high pressure systems. Spool design affords minimum turbulence and resistance to flow at secondary or operating discharge port. Unique differential piston gives minimum internal leakage—allows use of varied fluid viscosities at wide pressure-temperature ranges. Sizes ¼" to 1½". Write for details. Bulletin VR-2D. Denison Engineering Division, American Brake Shoe Co., 1166 Dublin Road, Columbus 16, Ohio.

CIRCLE 30 ON TIME-SAVER CARD

IT'S AMAZING...

the number of applications for

TETRASEALS

by Goshen Rubber

Rectangular-section rings deliver many important advantages!

Design engineers tell us TETRASEALS are not only amazingly high in performance, but amazingly versatile as well . . . using them in place of O-rings for static and in some cases moving applications. TETRASEALS are money-savers because they're interchangeable with standard O-rings, use the same groove, require no special tooling, and possess a homogeneous structure (non-laminated).

Edges are accurately formed, and cross-sectional tolerances are held to ±.003 (depending on ID and OD, on cross-section sizes and on material required).

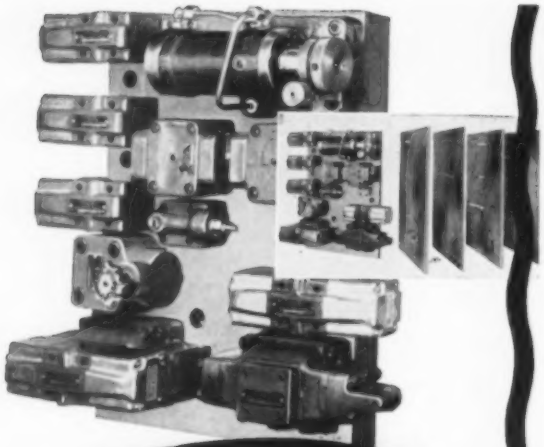
Only Goshen can supply TETRASEALS . . . in natural, synthetic and silicone rubber compounds to meet MIL, AMS, SAE, ASTM and industrial specifications.

Write for Technical Bulletin No. 11.

Goshen Rubber Co., INC.

1378 S. TENTH ST. GOSHEN, INDIANA

CIRCLE 48 ON TIME-SAVER CARD



ALMO

HYDRAULIC CONTROL MANIFOLDS

CONTROL SYSTEMS READY FOR OPERATION—NO CIRCUITS TO PONDER OVER AT INSTALLATION

Leading machine manufacturers use these manifolds to cut costs and obtain permanent trouble-free operation. Send your hydraulic circuit print and sketch showing desired take-off connections. We'll prepare a manifold proposal — No obligation.

ALMO TOOL COMPANY
11470 Kaltz — Centerline, Mich.

"Design Wise"

Colonial Broach Co. uses an Almo manifold in this 15 ton capacity, 66" stroke dual-ram broaching machine.

CIRCLE 24 ON TIME-SAVER CARD

POWER

IN SMALL PACKAGES

that SAVES you SPACE and WEIGHT!

MAC-38D
Double Ram, Double Acting Air Cylinder

MAC-38S
Single Ram, Double Acting Air Cylinder

MAC-38S
Spring Return, Single Acting Air Cylinder

MAN-12
12-Port Manifold

MAV-2 & 3
2 and 3-Way Air Valves

Tiny but TOUGH are these miniature pneumatic cylinders, valves and accessories, engineered for automatic work and control applications where weight and space saving is mandatory.

All are precision made for millions of cycles of trouble-free operation by the pioneer manufacturer of miniature pneumatic devices. Be sure to consider them, NOW, to speed production or improve work quality AUTOMATICALLY, or for improving the new products you are designing.

Clippard miniature pneumatic devices are sold by the nation's leading distributors of Fluid Power components. Write for interesting new catalog, NOW!

NEW! 9/16" bore Single & Double Acting Cylinders
4-way Air Valves—A.C. & D.C. Solenoids!

Clippard INSTRUMENT LABORATORY, INC.
7378-H Colerain Road, Cincinnati 39, Ohio
Manufacturers of R.F. Coils, Electronic Equipment, Miniature Pneumatic Devices

the 2569

MURPHY

SEPARATOR

does a smooth job of
SEPARATING and EJECTING
water, oil, scale, and rust from
COMPRESSED AIR LINES

YOU SHOULD HAVE FULL INFORMATION
Write now for FREE Data Sheet No. 2569

JAMCO

JAS. A. MURPHY & CO., INC.
1417 EAST HIGH STREET, HAMILTON, OHIO

CIRCLE 8 ON TIME-SAVER CARD

CIRCLE 83 ON TIME-SAVER CARD

NEW PRODUCTS

for sealing nylon pressure tubing to a metal flare body.

Specifications: Made in 1/8, 3/16, 1/4, 5/16, and 3/8 sizes. They have a standard 45° SAE flare and are recommended for pressures to 250 psi.

The Polymer Corp. of Penna.
Reading, Pa.

CIRCLE 321 ON TIME-SAVER CARD

HYDRAULIC CYLINDER
. . . is low cost

Designation: Hydra-nite

Features: Designed for use in the agriculture and industrial field on elevators, wagon hoists, dump bodies and lift cranes. Due to its

lower cost, the cylinder will allow the use of hydraulics in many places where cost has ruled it out in the past.

Specifications: Made in ½ to 3-inch bore with strokes from 1-inch to 8 ft, both single and double acting.

Green Mfg. Co.
Bowling Green, Ohio

CIRCLE 322 ON TIME-SAVER CARD

TUBE BENDER
. . . is king sized

Designation: Model 76

Features: Bender performs entire preset bending cycle in one operation. Each step in the cycle may be made separately for setup and prototype development.

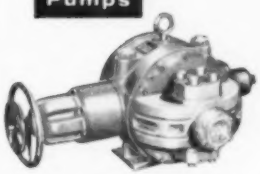
Specifications: Tubing to 6-inch OD and 20 ft in length can be bent. Maximum degree of bend is 180 with a maximum radius of 24 in. Machine is 23 ft long and weighs 14,500 lbs.

Leonard Precision Products Co.
Santa Ana, Calif.

CIRCLE 323 ON TIME-SAVER CARD

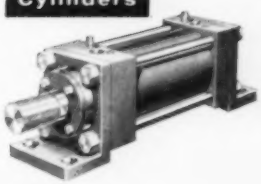
YES There's a Dependable Sales and Service Organization for H-P-M Hydraulics near You

Pumps



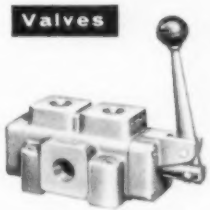
Fixed and Variable Displacement Radial and Gear Type Pumps 1000 psi to 3000 psi—1 to 185 gpm capacity.

Cylinders



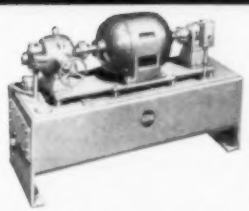
150 to 3000 psi—wide variety of mountings—standard and special types.

Valves



Directional and functional—1000 to 3000 psi—standard threaded, flange and subplate mounting—for every directional and functional valve requirement.

Packaged Power Units



Complete packaged units for hydraulic power to 3000 psi—power and control elements in compact units for versatile application.

BIRMINGHAM 1, ALABAMA
Chas. F. Wheelock & Assoc.
205 South 32nd St.
P. O. Box 1290

CINCINNATI, OHIO
Riggs Engineering Co.
P. O. Box 133
Ludlow, Kentucky

CHICAGO 36, ILLINOIS
Norman Engineering Co.
2115 West Marquette Rd.

CLEVELAND 9, OHIO
Pneu-Hydraulics Inc.
4330 Ridge Road

CRANFORD, NEW JERSEY
The Roden Company
P. O. Box 305

DAVENPORT, IOWA
Norman Engineering Co.
P. O. Box 431

DAYTON, OHIO
Anchor Rubber Company
840 South Patterson Blvd.

DETROIT 38, MICHIGAN
Russell & Olson Company
15820 James Couzens Hwy.

GREENSBORO, N. CAROLINA
Smith-Courtney Company
814-820 Winston Street
P. O. Box 928

HOUSTON 2, TEXAS
The H. L. Thompson Co.
1002 Esperson Building

INDIANAPOLIS, INDIANA
John R. Carlson
4808 Broadway

KANSAS CITY, MISSOURI
Blackman & Nuetzel Mach. Co.
212 Jewell Building
1103 East Armour Blvd.

LOS ANGELES 22, CALIFORNIA
Hydraulic Equipment Co.
5924 East Olympic Blvd.

MILWAUKEE, WISCONSIN
Norman Engineering Co.
743 North 4th Street

MINNEAPOLIS 21, MINNESOTA
Norman Engineering Co.
334 - 40th Avenue N.E.

PALMER, MASSACHUSETTS
Yahn Engineering & Sales Co.
350 Park St.

PHILADELPHIA 8, PENN.
Robert L. Porter
401 North Broad Street

PITTSBURGH 22, PENN.
The Hydraulic Press Mfg. Co.
A Division of Koehring Co.
512-513 Empire Building

RICHMOND 11, VIRGINIA
Smith-Courtney Company
Seventh & Bainbridge Sts.

ROCKFORD, ILLINOIS
Norman Engineering Co.
2500 North Main St.

SAINT LOUIS 8, MISSOURI
Blackman & Nuetzel Mach. Co.
3713 Washington Blvd.

SOUTH BEND 14, INDIANA
Norman Engineering Co.
1627 Southeast Drive

TULSA, OKLAHOMA
Blackman & Nuetzel Mach. Co.
101-111 West Archer Street

WASHINGTON 2, D. C.
J. H. Elliott Company
2101 New York Ave. N.E.

PORTLAND, OREGON
Power Transmission Products
1107 NW 14th Ave.

SAN DIEGO 1, CALIFORNIA
Hoffer Engineering Co.
1115 "F" Street

SAN FRANCISCO 3, CALIF.
Power Mac Corporation
467 S. Van Ness Avenue

FILE THIS AD FOR FUTURE REFERENCE

HPM

H811

HYDRAULIC POWER DIVISION

THE HYDRAULIC PRESS MFG. COMPANY

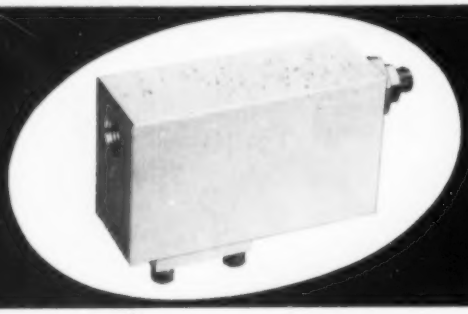
A DIVISION OF KOEHRING COMPANY • MOUNT GILEAD, OHIO, U.S.A.

CIRCLE 40 ON TIME-SAVER CARD

• *NEW* Dependable
COUNTER-BALANCE VALVE

... simplifies circuit design and installation

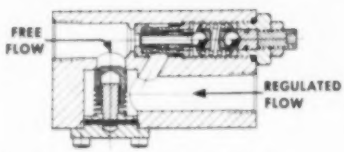
... Reduces piping costs



■ Small, integrated valve combines standard check valve and differential piston relief valve in a single body.

■ Dependable — holds pressure — will not stick open.

■ Low pressure drop.



Full Pressure Range: 100 to 3000 psi
Adjustable Pressure Ranges:
100 to 800, 250 to 1,500, 1,000 to 3,000
For Oil. Pipe Sizes: ⅜", ½", ¾"

Write for detailed literature.

Manufacturers of Hydraulic Valves and Devices

Relief Valves • Check Valves • Restrictor Valves
Needle Valves • Pilot Check Valves • Special Valves
Pressure Compensated Flow Regulators

Fluid Controls, inc.

1284 N. CENTER ST. • MENTOR, OHIO • BL 5-2625

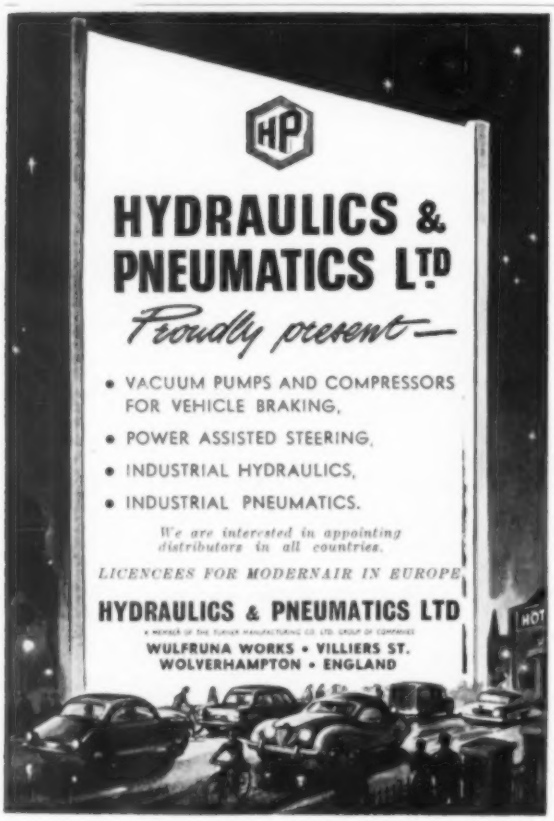
Member of National Fluid Power Association

USEFUL LITERATURE

VERTICAL 5-PLUNGER PUMPS . . . for high volume pumping are described in Bulletin 582 from *Ajax Iron Works, Corry, Pa.* Engineering drawings detail pump construction and curves and charts give complete specifications. Depending on plunger size, pressures range from 665 to 2335 psi.

CIRCLE 409 ON TIME-SAVER CARD

HYDRAULIC CYLINDERS . . . are covered in textbook style in new Bulletin JH-104N offered by *Miller Fluid Power Division of Flick-Reedy Corp., Melrose Park, Illinois.* 32-page booklet contains complete descriptive information on the new Model "J" cylinders for 500-2500 psi service and Model "H" cylinders for 3000-5000 psi service. Cylinder engineering data includes charts on column strength, piston rod deflections, acceleration, factors of safety, cylinder forces,


HP
HYDRAULICS & PNEUMATICS LTD
Proudly present—
• VACUUM PUMPS AND COMPRESSORS FOR VEHICLE BRAKING,
• POWER ASSISTED STEERING,
• INDUSTRIAL HYDRAULICS,
• INDUSTRIAL PNEUMATICS.
We are interested in appointing distributors in all countries.
LICENCEES FOR MODERNAIR IN EUROPE
HYDRAULICS & PNEUMATICS LTD
WULFRUNA WORKS • VILLIERS ST.
WOLVERHAMPTON • ENGLAND

CIRCLE 61 ON TIME-SAVER CARD

WORLD'S LARGEST ON-THE-SHELF STOCK OF HYDRAULICS
NEW PALLEY HYDRAULIC CYLINDERS –
Here are two of our newly developed lines of Industrial Hydraulic Cylinders. These cylinders are designed to meet the most rigid requirements of industry. All are double action with rugged steel construction. Type (A) is a heavy duty, external cap type cylinder which ranges up to a thrust of 37,500 lbs. Type (B) is flange mounted, Press type which delivers up to 21,000 lbs. thrust at 3000 PSI. For complete listing of our prices and our tremendous stocks send for Catalog below!
A AS LOW AS 56.45
B 36.00 AND UP
4-WAY – SLIDING PISTON HYDRAULIC VALVE
A newly developed hydraulic valve which can be connected in series to operate two or more cylinders, in unison or independently. Has a built-in relief valve, adjustable up to 3000 PSI. Maximum flow of 10 GPM. 2000 PSI type at $24.50 or 3000 PSI type at $32.75
ELECTRIC HYDRAULIC PUMP MOTORS AS LOW AS 99.50
Designed to direct-couple to aircraft type hydraulic pumps. For continuous duty with high starting torque. 115/230 V, 220/440V, 1 and 3 phase, 60 cycle AC. Sizes from 3/4 to 15 HP. Complete details in Catalog below.
GOV'T SURPLUS BUYS
VICKERS HYDRAULIC ANGLE PUMPS
Cat. No. GPM PSI RPM Price
H-P4A 5.3 1000 3000 $22.50*
H-P5A 2.7 1500 3000 25.75*
H-P4U 6 1000 3000 22.50*
*Used but excellent condition.
SPECIAL CATALOG
396 PAGES
Shows the largest stock of Hydraulic Equip. and Supplies ever stocked under one roof. Plus elect. motors, pumps, tools, etc. Send for your copy Today and SAVE!
2000 PSI HYDRAULIC CYLINDER SPECIAL Only 12.75
Genuine top quality Gov't Surplus. Used but excellent condition. Has a Bore of 2-1/4", Shaft 1", Stroke 4". Eye-to-eye lgth. 13½". Parts 1/4" AN.
Palley's
ORDER TODAY – Pay by Money Order or Check. ½ deposit with C.O.D.'s. All prices F.O.B. Los Angeles.
2263 E. VERNON AVE., DEPT. AH-78 LOS ANGELES 58, CALIF.

CIRCLE 91 ON TIME-SAVER CARD

pressure losses in pipes, factors to consider in selecting cylinders. There's information on air-oil devices, water-fitted cylinders, flange-fitted ports and the Miller high speed, self-regulating floating cushion.

CIRCLE 410 ON TIME-SAVER CARD

HIGH PRESSURE HOSE ASSEMBLIES . . . are the subject of Bulletin 200 from *Eastman Mfg., Co., Manitowoc, Wis.* This 32-page booklet offers a new approach in helping purchasing agents and design engineers meet

specifications for increasingly higher pressure requirements. Nine major sections of this bulletin are devoted to couplings suited to all types of hydraulic applications—including bent tube assemblies and automotive power assemblies. Tables opposite dimensional cross-section drawings make it easy to find and specify proper assemblies.

CIRCLE 411 ON TIME-SAVER CARD

HIGH PRESSURE COMPRESSORS . . . which provides 368 to 2000 CFM are described in Bulletin A-93 issued by *Joy Manufacturing Company Pittsburgh, Pa.* Installation photos, sectional drawings and charts deliver the complete story on the compressors which are designed for 300 to 500 psi service.

CIRCLE 412 ON TIME-SAVER CARD

TRANSMISSION APPLICATIONS . . . are detailed in Fluid Power News No. 5 released by *The Oilgear Company, Milwaukee, Wis.* Covered are: a hydraulic closed loop on a can closing and filling machine; a veneer clipper using a variable speed hydraulic drive giving table speeds over 100 fpm; hydraulics on expanders and shrinkers for sheet metal parts; and planers used to machine aircraft propeller blades. It's a "problem-solution" type of presentation.

CIRCLE 413 ON TIME-SAVER CARD

VALVE STOCK LIST . . . has been issued by *Automatic Switch Co. Florham Park, New Jersey.* The lists contains prices, valve ratings, flow diagrams, illustrations, engineering data. Ordering information is given for the two, three and four-way solenoid valves.

CIRCLE 414 ON TIME-SAVER CARD

HYDRAULIC 4-WAY AND FLOW CONTROLS . . . are detailed in two separate bulletins issued by *Denison Engineering Division, American Brake Shoe Co., Columbus, Ohio.* Bulletin 143A gives information on three sizes of infinitely variable, temperature and pressure compensated flow controls. Typical circuits and applications are shown. Bulletin 240B describes pilot-operated, solenoid controlled 4-way valves built to J.I.C. standards. Valve construction, spool configurations and circuits are given.

CIRCLE 415 ON TIME-SAVER CARD

Continued on page 127

BHEW

Custom-Built

HYDRAULIC CYLINDERS

Made-to-order to meet specific design requirements for any application in any industry.

Compactness! Efficiency! Close Tolerances! Outstanding operational performance! You get them all in BHEW cylinders. They require minimum mounting space. There is no tooling charge for BHEW cylinders, built to meet *your* specifications and delivered on schedule.

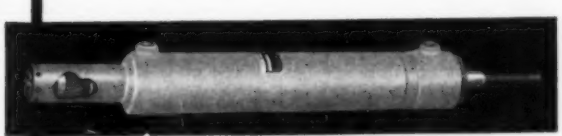
BHEW cylinders are available in standard and special O.E.M. designs . . . single or double acting and telescopic; 1½" to 8" bore; strokes up to 156"; oil hydraulic service in 1,500 psi or 3,000 psi working pressure, pneumatic up to 150 psi; cup-type, ring-type or O-ring construction; choice of mounting.

1 Cylinder barrel and non-adjustable gland welded into one piece, eliminates joint, makes small O.D. in large single and double-acting hoist cylinders.

2 Accurately honed barrel.

3 Hard chrome-plated rod.

4 Flow regulating or pilot operative check valve in base, when required.



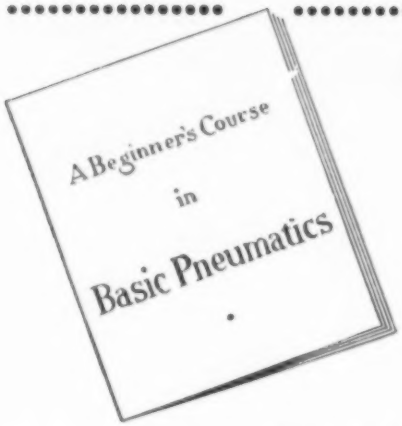
WRITE

for your copy of Hydraulic Cylinder Engineering Reference Data Manual. Can save you hours of time in specifying cylinders. 40 dimensioned basic designs for general and special purpose double acting cylinders.

BHEW

Benton Harbor Engineering Works, Inc.
622 Langley Avenue, St. Joseph, Michigan

CIRCLE 18 ON TIME-SAVER CARD



Again Available!

First printed in July 1954, 5000 copies of this popular booklet were bought by more than 800 companies and individuals. A second printing completed in March 1957 makes this course available to you.

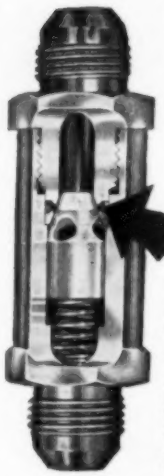
$1.50 per copy

Table of Contents

Section I
Air Properties and Characteristics
Introduction 1
Atmosphere and How We Use It 6
Gas Laws; Adibatic and Isothermal Compression 9
The Efficiencies and What They Mean 14
Section II
The Distribution System
Introduction—Friction, Leaks .. 20
How to Figure Friction Losses 23
Moisture in Air Lines 29
Distribution System Accessories 31
Air Hose 37
Section III
Power and Working Elements
Air Cylinders 41
Introduction to Air Valves 49
Poppet Type Air Valves 55
Sliding Plunger Type Air Valves 58
Diaphragm Air Valves 60
Index 63
Index of Tables and Charts 66

ORDER FROM APPLIED HYDRAULICS MAGAZINE
812 HURON ROAD • CLEVELAND 15, OHIO

CIRCLE 67 ON TIME-SAVER CARD



Simple, Secure ... Leak-Tight! this FLEXIBLE SEAL SEAT*

Here's the secret . . . responsive action of the soft, long-lasting O-ring seal! Instantly compresses to seal internal and external pressures. Draws harmlessly around dirt particles. No costly precision parts or extra end seals. Six standard Dryseal pipe and JIC tube sizes; 12 connection combinations. Send for data sheet.

KEPNER PRODUCTS COMPANY
7321 West 59th Street • Summit, Illinois

Kep-O-seal

HYDRAULIC & PNEUMATIC
CHECK VALVES

* PATENT APPLIED FOR

HYDRAULIC ENGINEERING
FOR INDUSTRY

CARDWELL
TRADEMARK SINCE 1829

DESIGN SERVICES
FABRICATION
POWER UNITS
HYDRAULIC PANELS
ELECTRICAL CONTROL PANELS
ACCUMULATORS
STOCKING DISTRIBUTORS
HYDRAULIC COMPONENTS

Complete Engineering and Design Services Are Available. Qualified Sales and Service Engineers in Most Areas.

The **CARDWELL MACHINE COMPANY**
Quality— A CARDWELL TRADITION SINCE 1829
Franklin at 19th St., Richmond 11, Virginia • Phone Milton 4-4593

Announcing—

A NEW GRESEN VALVE With FLOAT Position

GRESEN HYDRAULICS

A One or Two Spool Directional Control With Float Position

FEATURES: Detent in Float Position—Self Centering From Power Positions—Fully Balanced—Relief Valve Has Replaceable Hardened Seat—Tripod Mounting Feet—Smooth Positive Throttling Action—Hardened and Chrome Plated Spools.

SPECIFICATIONS: Capacity 20 GPM (at 20 Ft/seconds)—Maximum Pressure 1500 PSI—Parallel Application—Shipping Weight 22-1/2 Lbs.

Write for literature

GRESEN MANUFACTURING CO.
628 Colfax Ave. N. Dept. AH-78 Minneapolis 11, Minn.

CIRCLE 20 ON TIME-SAVER CARD

CIRCLE 50 ON TIME-SAVER CARD

CLEANER, COOLER, DRYER AIR . . . is the subject of a new bulletin published by *Jas. A. Murphy & Co., Inc., Hamilton, Ohio.* Along with a cutaway drawing of the ASF-aftercooler, separator, filter, specifications and buying information are tabulated.

CIRCLE 418 ON TIME-SAVER CARD

ADVANTAGES OF TEFLON . . . are detailed in 4-page Bulletin CT-1 available from *Chicago Rawhide Manufacturing Company, Chicago, Illinois.* Here's information about complete facilities for the design, compounding and molding of packaging, gaskets and other parts of reinforced Teflon. Bulletin lists the thermal, mechanical, and frictional properties which Teflon imparts to packings for fluid power systems.

CIRCLE 419 ON TIME-SAVER CARD

BRONZE PUMPS . . . will deliver from 2 to 50 gpm at pressures to 400 psi. They're described in Catalog 109 issued by *Tuthill Pump Company, Chicago, Illinois.* Designed for marine use, these 61 models are used for many jobs including hydraulic power transmission. Model selection charts, mounting data, performance curves and tables are published in the catalog. These pumps are rotary internal gear type.

CIRCLE 420 ON TIME-SAVER CARD

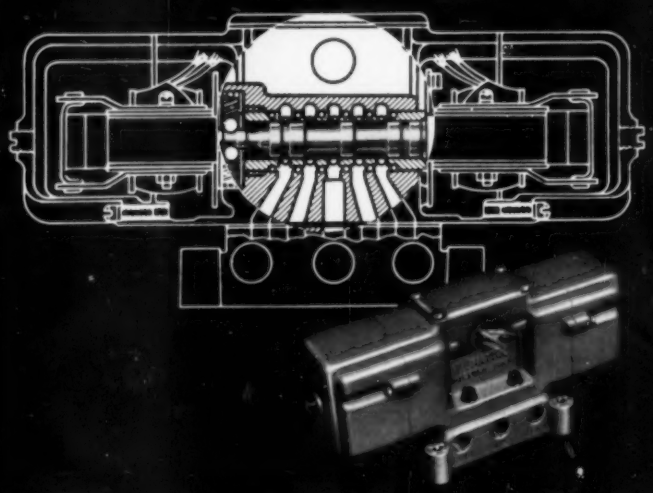
RELIEF VALVE GUIDE . . . describes pilot-operated, differential piston, guided piston and spring-loaded poppet types made by *Fluid Controls, Inc., Mentor, Ohio.* This guide lists the factors to be considered when specifying a relief valve plus the advantages and limitations of each valve. In addition, each type is illustrated by a schematic drawing to show basic construction.

CIRCLE 421 ON TIME-SAVER CARD

DRY BEARING MATERIAL . . . is provided by a new combination of Teflon, lead, porous bronze, and steel. Called DU, this material is described in a brochure offered by *United States Gasket Company, Camden, New Jersey.* Using charts and tables this 8-page brochure emphasizes the material's compressive strength (up to 23 tons per sq in), its wear resistance (up to 100 times that of other self lubricated bearings) and its wide operating temperature range (from 328 below zero to 536 above).

CIRCLE 422 ON TIME-SAVER CARD

It's the air valve with the floating sleeve-lapped spool design



50 million cycles without a sign of wear!

This is not just a claim, it's a fact! And Numatics has the verified case histories to prove it . . . cases where Numatics SA Series valves are still performing like new after well over 50 million operations. *And not on a test bench under ideal conditions,* either, but out in the field on high speed welding guns, punch press scrap choppers, high speed packaging machines and other actual installations.

With the floating sleeve-lapped spool you can expect *and get* this kind of performance from every Numatics valve, because the spool has no seals or packers to wear out . . . it floats on a fluid film, never contacts the sleeve wall. The sleeve floats, too, on O-rings which isolate it from the valve body. Both spool and sleeve, what's more, are specially heat treated stainless steel, close-tolerance finished to minimize friction. In a nutshell, Numatics valves are designed and built to give you longer, more trouble-free life than is possible with ordinary air valves. Want a catalog? Send for it!

LOOK TO NUMATICS FOR LINE VALVES, TOO . . .

Numatics offers a complete *line of high speed, heavy duty 2-and 3-way in-line valves . . . valves you can depend on for top performance, long life, minimum maintenance and applications unlimited. And we'd like to* prove *it! May our representative call on you?*

NUMATICS, Inc. HIGHLAND, MICHIGAN

SALES REPRESENTATIVES FROM COAST TO COAST

CIRCLE 88 ON TIME-SAVER CARD

CIRCLE 93 ON TIME-SAVER CARD

HAND HYDRAULIC PUMPS

Single and Double
Designs to 20,000 PSI
With or Without Reservoir

160 Cubic Inch Reservoir with 8" x 8" Base Plate. Optional Size Piston: ⅜", ½", ¾", 1".

Handle length: 18 inches
Catalog No. 160

We specialize in hand pump units to operate in temperatures from minus 65F to plus 160F and with any capacity reservoirs required.

The single pump with ½", ¾", 1" or 1½" piston now available in stainless steel.

WILLIAM S. PINE
Hydraulic Hand Pumps for 1001 Uses
1635 E. 22nd St., Los Angeles 11, Calif.

POST SCRIPTS OF INDUSTRY

News about people, manufacturers and sales organizations

The board of directors of **Linear, Inc.**, Philadelphia, Pa., has elected **A. W. Swartz, Jr.** and **W. T. Davis** to the posts of

A. W. Swartz, Jr.
Linear, Inc.

W. T. Davis
Linear, Inc.

executive vice president and vice president in charge of manufacturing. Swartz has been with the company for 20 years and has been vice president in charge of production. Davis joined the company in 1956.

Eagle Signal Corp. Moline, Ill., has acquired a 20 acre tract, located near Moline, for future expansion. The site will be used to construct a plant that will replace present facilities in Moline and Davenport, Iowa.

M. R. Fox, for the past nine years head of the Detroit district sales office of **Vickers Inc.,** has been promoted to product planning manager of the Machinery Hydraulics Division. Succeeding Fox as head of the Detroit sales

M. R. Fox
Vickers Inc.

A. Van Wormer
Vickers Inc.

Al Trail
Vickers Inc.

Donald Rhodes
Vickers Inc.

office is **Arthur Van Wormer,** Cleveland district manager for the last four years. **Al Trail** has become district manager at Cleveland after two years at Vickers' Rochester, N. Y. office. **Donald Rhodes** will take over the district sales manager's position at Rochester.

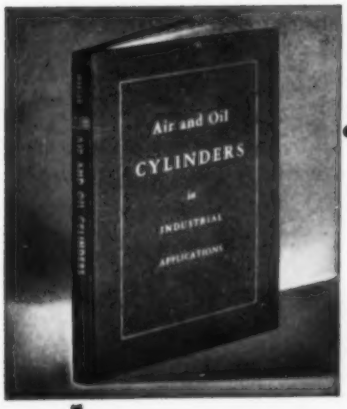
Continued on page 130

LOXSWITCH
—by the Hundreds!
FORD MOTOR COMPANY Bumper Plant!
Over 500 Denison LOXSWITCH Heavy Duty Limit Switches provide reliable switch control for Ford's new multi-million dollar bumper plant at Monroe, Michigan. LOXSWITCH Limit Switches last for millions of actuations under severe operating conditions. They feature the soundest electrical circuit, the longest mechanical life, plus low actuating force and 70° safety overtravel. All 13 models are water-, dust- and oil-tight at no extra cost! Switch to low-cost LOXSWITCH today.
FREE CATALOG 956 describes single pole-, double pole, multiple circuit and neutral position switches. Send for complimentary copy.
DENISON LOXSWITCH
R. B. DENISON MFG. CO.
102 ST. CLAIR AVE., N. W. • CLEVELAND 13, OHIO
SPECIALIZING EXCLUSIVELY IN LIMIT SWITCHES

CIRCLE 108 ON TIME-SAVER CARD

Write... for this valuable NEW Catalog Bulletin

SPAN BRASS MFG. CO. INC.
OTSEGO, MICHIGAN



AIR & OIL CYLINDERS

Elmer Heiser has written this valuable cylinder handbook which tells about types, cushions, how to order, proper porting, correct sizing, packings, and efficient installation methods.

It's full of application ideas.

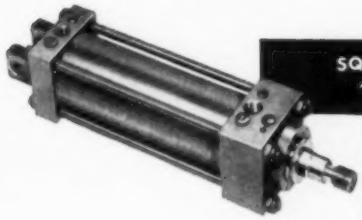
PRICE $5.00

The Industrial Publishing Corporation
812 Huron Road • Cleveland 15, Ohio

for that

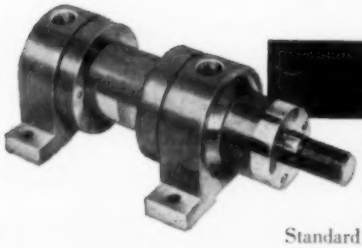
BIG PUSH

LINDBERG HAS THE RIGHT CYLINDER



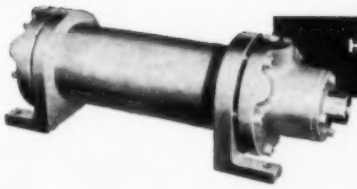
SQUAREHEAD "S" LINE

A feature packed line with the "quick change" feature • Rated 250 psi for air, up to 1000 psi hydraulic • 7 bore sizes thru 6" • Standardized mounting dimensions.
WRITE FOR BULLETIN S-101



2000 PSI "H" LINE

An extra heavy duty hydraulic cylinder • Available with or without cushions • Standard or 2:1 rods • Bore sizes through 8 inches in 5 mounting styles.
WRITE FOR BULLETIN H-101



HEAVY DUTY "A" LINE

A rugged non-tie rod cylinder for air pressures up to 150 psi and low pressure hydraulic service. Bore sizes through 12 inches • Cushions optional • 5 mounting styles.
WRITE FOR BULLETIN A-101

OTHER CYLINDERS
For fast action on mill type cylinders or specials designed to suit your exact needs, send outline of your requirements to our factory.

MEMBER N.F.P.A.

LINDBERG AIR and HYDRAULIC DIV.
TEER, WICKWIRE & CO.
1802 WILDWOOD AVE., JACKSON, MICHIGAN

CIRCLE 1 ON TIME-SAVER CARD

Fall . . . *the original*

SPRING LOADED

Wiper **Ring**

with SQUEEZE GRIP ACTION

True Circle wiper edge is tight against the rod at all times regardless of wear.

Fall Wiper Ring consists of three pieces assembled into one integral unit. In use since 1944 by Military and Aviation Industry. Spec. AN6231-, AN6231A-, MS28776- 1/2" to 13" dia. Plain or Spring Loaded. Spec. MIL-S-5049 or any commercial use.

If you have a wiper ring problem write, wire or phone us.

ACE PRODUCTS CO.

Toledo 1, Ohio Phone Cherry 3-6513
Est. 1935

POST SCRIPTS OF INDUSTRY

George C. Scott has joined **Watts Regulator Company,** Lawrence, Mass., as application engineer for its Industrial Division.

Sealtite Corporation, St. Louis, Missouri was named a distributor for Parker tube and hose fittings. **W. R. Kublin,** Sealtite's president, stated that the company will carry an extensive range of stocks.

Robert A. Shuey Company, Dallas, Texas, opened a sales office in Houston, Texas. **Elwood H. Carpenter** is in charge.

E. B. Miller Company, with offices in St. Louis, Missouri has been named sales agent for the **Conoflow Corp.,** in eastern Missouri and southern Illinois.

The Belmont Packing & Rubber Company, Philadelphia, Pa., elected **John W. Russell** vice president in charge of sales. Russell joined Belmont in 1957 and was formerly associated with The Garlock Packing Co.

John W. Russell
Belmont Packing

R. H. St. Arnaud
Rousseau Controls

Rousseau Controls Ltd., Montreal, have been appointed Canadian representatives in the provinces of Ontario and Quebec for **Fluid Controls, Inc.,** Mentor, Ohio. Rousseau Controls is headed by president and general manager **Frank H. Rousseau. R. H. St. Arnaud,** manager of their central sales division (Ontario) was named to handle the Fluid Controls line.

Continued on page 132

Modernair **HEAVY DUTY CYLINDERS**

for Air or Hydraulic Service

Developed to meet the need for a rugged, reliable cylinder, for heavy mill-type service, MODERNAIR's new Heavy Duty Series are made in two types:

HA • for air service to 200 psi. **HH** • for hydraulic service to 1,000 psi.

Both types are available in 3¼", 4", 5", 6" bore sizes, optional stroke length.

Features include:

★ Rolled steel heads
★ Extra-heavy tie rods
★ Heat-treated, chrome plated piston rods
★ Self-adjusting "Uneepac" rod seals
★ Needle valve cushion adjustment

Write for catalog, prices today—or phone your local MODERNAIR distributor (listed on your phone book Yellow Pages).

Modernair CORPORATION

Dept. B-7, 400 PREDA STREET, SAN LEANDRO, CALIF.
Member National Fluid Power Association 31

CIRCLE 81 ON TIME-SAVER CARD

see the latest in
AIR AND STEAM CLEANERS

send for
ANDERSON'S NEW Hi-eF CATALOG *FREE*

● Here is complete data on revolutionary Hi-eF air and steam cleaners. These astounding devices require no maintenance whatsoever. They have no troublesome filters to replace. Moisture and foreign particles are removed from pipelines by centrifugal force without the use of any moving or replaceable parts. Prolong the life of all pneumatic and steam equipment. Low cost. Mail reader service card for free copy of Bulletin 502 today!

ANDERSON Hi-eF PURIFIERS

THE V.D. ANDERSON COMPANY
division of International Basic Economy Corporation
1936 West 96th Street • Cleveland 2, Ohio

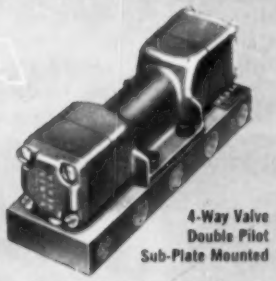
CIRCLE 13 ON TIME-SAVER CARD

CIRCLE 123 ON TIME-SAVER CARD

FOR SUB-PLATE MOUNTING

VERSA

Manifold Mount VALVES



4-Way Valve
Double Pilot
Sub-Plate Mounted

For any type of operation...there's a Versa Control Valve available for manifold mounting. These efficient, compact Control Valves are ideal for incorporation as original equipment. They can be installed directly on equipment or mounted on standard Manifold Plates (or Sub-Plates).

Versa Manifold Mount Valves are available with any type of actuating device, in sizes from 1/8" to 1" NPT, in 2-, 3-, 4-, and 5-Way Types, and for pressures from partial vacuum to 500 PSIG.

Over 110,000 Variations...
Available for Immediate Delivery!

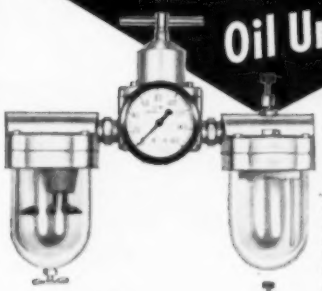
Write today for your free copy of Versa's Catalog E-14

VERSA

VERSA PRODUCTS COMPANY INC.
248A SCHOLES STREET, BROOKLYN 6, N.Y.

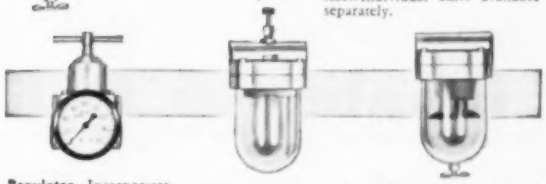
CIRCLE 5 ON TIME-SAVER CARD

AIR-MITE
FILTER—REGULATOR
Oil Unit



- Instantaneous response to demand
- Special Filter for cleaner air
- Accurate injection of pre-atomized oil

The new AIR-MITE unit is designed and built for maximum operating efficiency, easy maintenance and long life. Operates at pressures to 160 psi. Available in ¼", ⅜" and ½" T.P. sizes. Individual units available separately.



Regulator—Incorporates piston cup instead of diaphragm. Provides more accurate, stable regulation, lasts longer. Direct reading gauge for close regulation of outlet pressure.

Lubricator — Automatically pre-atomizes and feeds oil mist into air stream. Simple micro adjustment permits accurate balance of oil-to-air supply.

Filter — Porous sintered bronze element filters better . . . won't collapse . . . is easy to clean. Built in air baffle. Brass drain cock.

Write for catalog sheets and prices.

AIR-MITE Devices, Inc.

4401 W. KINZIE • CHICAGO, ILLINOIS

What a sight!

CENTURY'S

All-new Oil Level Sight Gage

- No Easier Installation Ever Designed
- Better Visibility at any Height
- Leak-proof—No Dripping
- Streamlined Modern Appearance
- Important Savings in COST
- Available NOW From STOCK

Send for new catalog containing dimensional information on hydraulic reservoirs and complete line of power unit accessories.

CENTURY HYDRAULICS, INC.
7703 LYNDON AVE. • DETROIT 38, MICHIGAN
Telephone: Diamond 1-3797

Are your Airlines LAZY?

. . . THEN USE
TRU-FLATE
QUICK COUPLERS
AND NIPPLES

- "More Air" with minimum line turbulance and pressure drop.
- Heavy Duty construction—light in weight—easily repaired—competitively priced.
- Stocked in Sleeve Type series (as illustrated) in sizes ⅛" to 1" or Push Type series in sizes ⅛" to ½".
- Specialty couplers available for oxygen, acetylene, freon, ammonia, oil, steam, and low pressure gas.
- Interchange couplers and nipples, in both Sleeve Type and Push Type for most competitive makes.

Send for Free Descriptive Catalog Page

TRU-FLATE® INC.

888 — 92nd AVENUE • OAKLAND 3, CALIFORNIA

CIRCLE 21 ON TIME-SAVER CARD

CIRCLE 115 ON TIME-SAVER CARD

POST SCRIPTS OF INDUSTRY

Three new field sales representatives have been named by the **U. S. Gauge Division of American Machine and Metals, Inc.** **V. Dallis,** branch manager of Atlanta office. **F. A. Hebenstreit,** sales engineer at Chicago office. **G. R. Preisick,** aircraft sales in New York office.

Graig S. Kirkpatrick was named advertising manager and director of public relations, and **George Mastel** was appointed Controller of **Minnesota Rubber Co.**

Craig S. Kirkpatrick Minnesota Rubber

H. W. Griesbach Flexonics Corp.

Howard W. Griesbach was named vice president in charge of operations at **Flexonics Corp.,** Maywood, Ill., and has been elected a director of the company. He heads up all the company's production and sales activities under a new organizational plan based on five major operating divisions. His election to the board of directors at Flexonics brings the number of directors to ten.

The Hydraquip Corporation has opened a new office and warehouse at 1517 Levee Street, Dallas, Texas, to serve the Dallas-Fort Worth Area. **Glen Larsen** is sales manager for this area and **Joe Finley** is office manager.

Sweetland Company has opened a Seattle, Washington, office with complete sales, engineering and service facilities. **Russell E. Schulke** will be in charge of the Seattle operation.

Mechanical Rubber & Supply Co., Peoria, Illinois, was appointed to handle the complete **Belmont Packing and Rubber Co.** line in south-central Illinois.

W. C. Denison, president of **Denison Engineering Division, American Brake Shoe Company,** Columbus, Ohio, announced these appointments: **Robert F. Norris,** to plant manager of the engineering division's Delaware, Ohio, plant, with complete charge

Robert F. Norris Denison Engr. Div.

Carl W. Lindahl Denison Engr. Div.

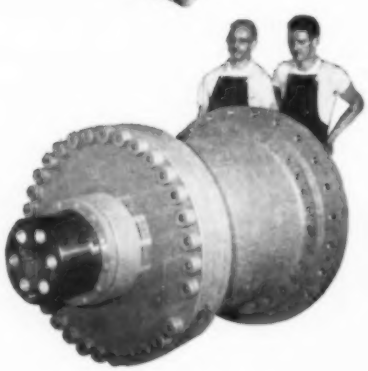
of all Delaware plant manufacturing operations. **Carl W. Lindahl,** to works manager in charge of all Denison manufacturing activities at the Columbus plant, which includes the multipress and hydraulic pump, motor and controls division. **George T. Hays,** to director of purchasing for the Denison Engineering Division.

Lincoln AIR AND HYDRAULIC Cylinders

The answer to the increased demand for rugged, heavy duty air and hydraulic cylinders. Designed for the hardest usage in Steel Mill operation or for the hundreds of other modern cylinder applications that require dependable efficient service.

HYDRAULIC RAM
166" Stroke—10"
Stainless Steel Rod
1000 PSI Oil Pressure
For Aluminum Ingot Lift
On D. C. Casting Units

WRITE FOR NEW COMPLETE CATALOG



HYDRAULIC CYLINDER
52" Bore—24" Stroke
2000 PSI Oil Pressure
Lifting Capacity Equals
1,600,000 lbs.
For Oil Shale Retorts.

JACK CYLINDERS
For Mining Operation
10" Bore—140" Stroke
2000 PSI Oil Pressur

Lincoln MACHINE CO. INC.

P. O. Box 272 EDgewood 2-4689 Salem, Ohio

CIRCLE 6 ON TIME-SAVER CARD

AIROYAL

5/8 INCH BORE

AIR-OIL CYLINDER

If you've been using 1" or larger bore cylinders for those applications in which you wanted the "smallest" bore, here are some of the benefits you'll derive from the new AIROYAL ⅝" bore cylinder: more compact size; reduced thrust from a given pressure; lower piston and rod inertia; increased velocity from a given flow input.

Single and double acting. Other bore sizes 1", 1½" and 2".

These cylinders carry the standard Airoyal guarantee: they are unconditionally guaranteed against breakage — forever.

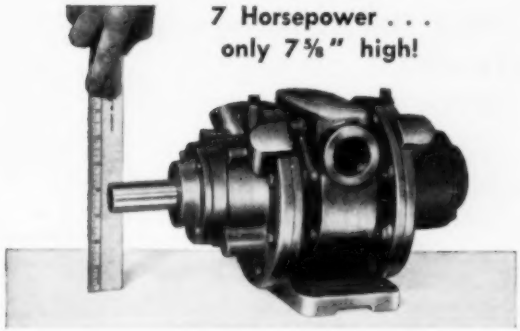
THE AIROYAL MFG. CO.

FLUID POWER

1990 SPRINGFIELD AVENUE
MAPLEWOOD, NEW JERSEY

CIRCLE 46 ON TIME-SAVER CARD

7 Horsepower . . . only 7⅝" high!



It's NEW! Variable-speed Model 16AM

GAST AIR MOTOR

Here's compact, explosion-proof power! Only 14⅜" x 8" x 7⅝" — wt. 65 lbs. — yet up to 7 h.p. on 90 lbs. air pressure. Speed variable from 300 to 2,000 r.p.m. with simple valve control. Overloads can't burn it out — stalling does no harm.

Has foot, also tapped holes for flange mounting to your machine. Use as original equipment or in plant to drive hoists, mixers, pumps, fans, etc. Priced at $200.

Write for your copy of Bulletin 16AM.

GAST MANUFACTURING CORP., P.O. Box 117-D
Benton Harbor, Michigan

See Catalog in Sweet's Design File

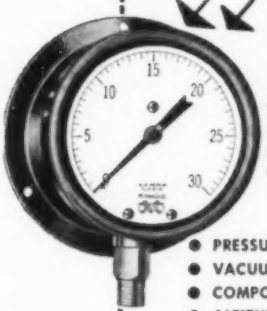
GAST ROTARY

- AIR MOTORS TO 7 H.P.
- COMPRESSORS TO 30 P.S.I.
- VACUUM PUMPS TO 28 IN.

"Air may be your answer!"

MARSHALLTOWN

THE RIGHT GAUGE FOR YOUR SPECIFIC NEEDS



Available in a wide variety of general purpose and special purpose gauges in pressure ranges to meet your specifications in every particular.

- PRESSURE
- VACUUM
- COMPOUND
- ALTITUDE
- COMBINATION
- DIAPHRAGM
- HYDRAULIC
- AND SPECIAL PURPOSE GAUGES
- DIAL THERMOMETERS (Vapor Tension or Bi-Metal)

WRITE TODAY FOR COMPLETE INFORMATION

MARSHALLTOWN MFG. COMPANY
MARSHALLTOWN 4, IOWA

UP TO 3.5:1 MECHANICAL ADVANTAGE AUTOMATICALLY!

DOUBLE ACTING Toggle Linkage Hand Pumps

Just select the proper portion of the stroke

Models for 1000, 3000, and 10,000 P.S.I.

Hydraulic pumps, needle valves, 4 and 5 way valves, electric pumps, hydraulic wheels.

Write Dept. AP-7

MECHANISMS CO.
118 E. 2nd St. • Uhrichsville, Ohio

CIRCLE 75 ON TIME-SAVER CARD

CIRCLE 78 ON TIME-SAVER CARD

CIRCLE 85 ON TIME-SAVER CARD

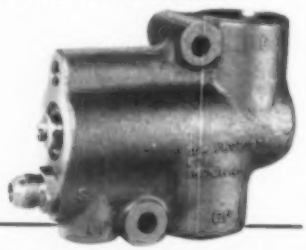
TWO SIMULTANEOUS HYDRAULIC OPERATIONS WITH ONE PUMP

•••••••

NEW PRODUCTS FLOW DIVIDER WITH A BUILT-IN MEMORY

What it does!

- Permits two simultaneous hydraulic operations with one pump.
- It remembers to reduce flow at primary port when secondary operation is required (Patent Pend.)
- Divides hydraulic flow in any desired proportions.
- Adjustable to decrease flow at controlled flow side when excess flow side is worked.
- Built-in relief valve bypasses oil back to sump when peak pressure setting of secondary flow is reached.
- Handles fluid at any temperature.
- Operates on low circulation pressure.
- Quiet, simple, easy to install and service.



NEW PRODUCTS CORPORATION

3636 Oakton Street, Skokie, Illinois

THE MARKET PLACE

When replying to a box number in the Market Place, address your letter to Applied Hydraulics, 812 Huron Road, Cleveland 15, Ohio. Attention: Box No.

SOUTHERN CALIFORNIA MANUFACTURERS REPRESENTATIVE

Wants additional lines, can offer 15 years experience in sales and engineering in hydraulics, pneumatics, automation, etc. in Southern California. Write to Box 7158 APPLIED HYDRAULICS.

SALES ENGINEER

Leading manufacturer of industrial products offers exceptional career opportunities. Require experienced salesman, age 25 to 35, willing to relocate. After factory training, will represent company calling on manufacturers and distributors. Salary, incentive commission and expenses. Write giving background, experience and qualifications. Replies confidential.

Industrial Sales Department
Aeroquip Corporation
Jackson, Michigan
Mr. M. Lloyd Jones

SALES ENGINEER

Six years experience pneumatics and hydraulics field, age 27, commercial, instrument pilot. Would like position utilizing one or both qualifications. Write Box 7358 APPLIED HYDRAULICS.

RUBBER SEAL ENGINEER

Eastern rubber manufacturer has unusual opportunity for a product or project engineer with experience on rotary shaft seals for hydraulic or pneumatic applications. Immediate opening. Send resume. Write Box 7258 APPLIED HYDRAULICS.

DESIGNERS WANTED

Chicago manufacturer needs top-notch high pressure hydraulic valve designers. These are not desk jobs. We want men who can design and detail new valves and follow through with development and research until valves are in production. Write Box 7458 APPLIED HYDRAULICS.

FOUNDRY WANTED

Manufacturer located near Chicago wishes to contact a midwest organization with extensive experience and facilities required for the production of high quality alloy iron castings for high pressure hydraulic valves. Write Box 7558 APPLIED HYDRAULICS.

Classified Advertising Rates: Cost of Position Wanted Ad is $10.00 for the first inch, each additional line 90 cents. Cost of all other classified ads is $20.00 for the first inch and $15.00 for each additional inch or fraction thereof. Rates for Display Ads in this section will be sent on request.

40 feet of precision hole by AMERICAN

As specialists in boring and honing we ask for your difficult cylinder jobs. We are equipped to handle one or one thousand parts with dispatch. Send your prints for estimates—you'll save time and money.

TELEPHONE ERIE 2-3664

PRECISION INTERNAL MACHINING AHB

MANUFACTURERS OF HYDRAULIC CYLINDERS • SPINDLES • SLEEVES CLUTCH SHAFTS • PISTON RODS • RAMS • QUILLS, ETC.

AMERICAN HOLLOW BORING CO.

1954 Raspberry St., Erie, Pa.

COMPRESSED AIR DRYERS AND CLEANERS

VAN-AIR DRYERS purify raw compressor air – extract water up to 1.07 lbs. per 1000 cu. ft. – reduce moisture to ZERO-dewpoint – remove contaminating bacteria, scale, etc. – deliver air uniformly clean and dry.

VAN-AIR DRYERS have no elements to heat, regenerate or regulate – average ten minutes care per month – process air automatically with a non-corrosive desiccant (see diagram) – operate with less than 1% pressure drop.

Many plants, shops and labs use the VAN-AIR to protect instruments, testers, circuits, etc. Others use it to prevent fouling of chemicals, compounds, plastics, foods, drugs, etc. Some need it to reduce spoilage in product finishing, spraying, blasting, packaging, assembling, etc. Capacities range up to 8000 scfm, 6000 psig.

See it in action, Van Products Booth, Instrument-Automation Exhibit, Convention Hall, Philadelphia, Sept. 15-19. Send NOW for brochure.

VAN PRODUCTS CO. • MFRS.

5713 SWANVILLE ROAD, ERIE, PA.

CIRCLE 10 ON TIME-SAVER CARD

CIRCLE 122 ON TIME-SAVER CARD

ADVERTISERS' INDEX
JULY 1958

A

Ace Products Company 130
R. P. Adams Co., Inc. 135
Adel Precision Products Division General Metals Corp. 46
Aero Gasket Company 112
Air-Mite Devices, Inc. 131
Airoyal Company 133
Alemite Division, Stewart Warner Corp. 47
Almo Tool Co. 122
American Engineering Co. 44
American Hollow Boring Co. 134
American Standard Ross Heat Exchanger Division 73
Anchor Coupling Co., Inc. 5
V. D. Anderson Co., Purifier Division 130
Arrow Tools Inc. 120

B

Barksdale Valves Cover 3
Behlen Manufacturing Co. 14
Bellows Company 77
Benton Harbor Engineering Works 125

C

Celanese Corp. of America Chemical Division 39
Capital Engineering & Mfg. Corp. 116
Cardwell Machine Co. 126
Century Hydraulics, Inc. 131
Chicago Rawhide Mfg. Co. 31
Chiksan Company 113
Clippard Instrument Laboratory, Inc. 122
Commercial Shearing & Stamping Co. 73
Cross Mfg. Company 135

D

Darling Valve & Mfg. Co. 118
Davey Compressor Co. 119
Denison Engineering Division American Brake Shoe Company 17, 121
R. B. Denison Mfg. Co. 128
Detroit Coil Co. 41
John L. Dore Company 117
Dukes Company, Inc. 28

E

Eagle Signal Corporation 16
Eastman Mfg. Co. 12
Electro-Snap Switch & Mfg. Co. 121
Ex-Cell-O Corp. Rotac Division 98

F

Flexonics Corp. 136
Flodar Corporation 90
Fluid Controls, Inc. 124
S. G. Frantz Co., Inc. 94
Fulflo Specialties Co., Inc. 36
Fuller Company 34

G

Gabb Special Products, Inc. 114
Galland-Henning Mfg. Co. Nopak Division 33
Gast Mfg. Corp. 133
Gits Bros. Mfg. Company 43
Goshen Rubber Co., Inc. 121
Greer Hydraulics, Inc. 107
Gresen Mfg. Co. 126

H

Hall & Hall Ltd. 48
Hanna Engineering Works 1
Hansen Mfg. Co. Cover 2
Hein-Werner Corp. 38
Helicoid Gage Division American Chain & Cable 24
Hilliard Corp. 4
E. F. Houghton & Co. 19
Hydraulic Accessories Co. 119
Hydraulic Power Division Hydraulic Press Mfg. Co. 123
Hydraulics and Pneumatics Ltd. 124

J

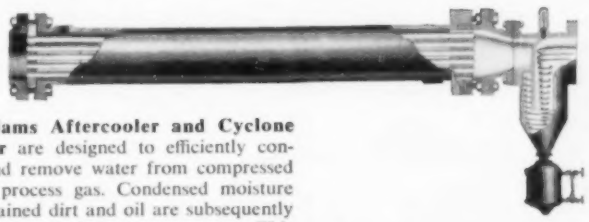
James Pond & Clark, Inc. 109
Johns-Manville 6
Jones & Laughlin Steel Corp. 45

K

Kalamazoo Division New York Air Brake Co. 95
Keelavite Rotary Pumps & Motors Ltd. 75
Kepner Products 126
Koppers Co., Inc. 26, 27

Aftercooler and Cyclone Separator designed for cleaner, dryer compressed air

R. P. ADAMS CO., INC.
249 East Park Drive, Buffalo 17, New York



The Adams Aftercooler and Cyclone Separator are designed to efficiently condense and remove water from compressed air and process gas. Condensed moisture and entrained dirt and oil are subsequently removed in a cyclone type separator. This unit is scientifically designed for maximum removal efficiency over a wide range of flow rates.

For normal use, units are available to cool gases to within 10° F of the temperature of the cooling water. Specially designed units are available to permit a 2° F approach to cooling water temperature, for application where low moisture content is critical.

Adams Aftercoolers and Separators are available from stock to handle 20 - 40,000 cfm with 10° cooling and 25 - 19,200 cfm where it is necessary to cool within 2°F of the cooling water. Special units can be supplied to suit an unlimited range of requirements. In all cases the maximum pressure loss at rated capacities is ½ psi.

This wide range of sizes enables the economical utilization of Adams Aftercoolers and Separators in virtually all industrial application. For further information on how R. P. Adams' units will solve your compressed air problems and save you money, write today for Bulletin 711.

ON THE JOB...
with CROSS
HYDRAULIC CYLINDERS

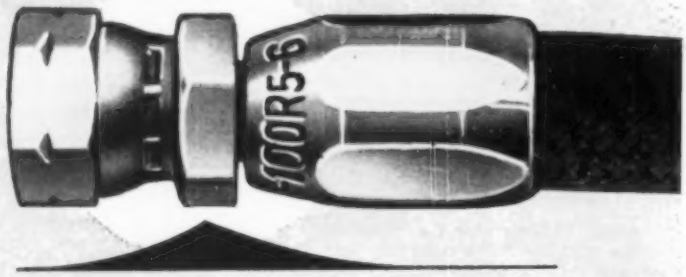
Like Cross customers everywhere, you can stay "on the job" with dependable, rugged Cross Hydraulic cylinders. Cross, the trade-mark of quality in hydraulic cylinders, is as near as your phone. For fast delivery on any quantity, built to your specifications, contact Cross Engineering Department.

Lowest Priced Engineered Quality Cylinders Available

Try Cross Cylinders in your operation... low cost, dependable, and trouble free.

CROSS MANUFACTURING CO.
LEWIS, KANSAS—EA 45525
WRITE • WIRE • PHONE

Save Time and Money
with Flexon Reusable Hose Fittings



ALL FLEXON REUSABLE FITTINGS now equipped with Easy Grip Hex for simple, speedy attachment

There's no longer any need to struggle with special tools when you attach reusable hose fittings. Now you can attach reusable fittings the easy way . . . if the fittings are FLEXON.

Every FLEXON reattachable fitting—male or female—has a hex on the stem. You can get a good grip on the fitting with an ordinary wrench for faster, easier insertion into the hose. And there's no danger of damaging the threads or of damaging the seat of female couplings.

For your hose connector requirements where the serviceability of reusable fittings is desired, improve that serviceability by specifying FLEXON Reusable Fittings with the Easy Grip Hex. Sizes start at $\frac{3}{16}$" hose I.D.

For all your hose assembly requirements take advantage of Flexon know-how. It may be the first step towards reducing your over-all fluid power costs.

Flexon offers the Complete Line

- Bulk hose in a wide range of types and sizes.
- Hose assemblies with standard or special fittings for all pressures.
- A full line of crimped, reusable, swaged, push-on and special fittings, for all services.

On-The-Spot Service for all Your Hose Needs

Your nearby Flexonics field man is as near as your telephone to give you prompt, competent service on all your flexible hose needs. For your further convenience, his service is backed by strategically located warehouse stocks. In addition, the assistance of the Flexonics Hose Application Engineering Department is available to help you with "special" problems. Get all your hose needs from this single, dependable source.

Flexonics Corporation RH-10

Mr. Flexon identifies products of Flexonics Corporation that have served industry for over 56 years.

1385 S. Third Avenue • Maywood, Illinois

In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

Manufacturers of metal and rubber hose, expansion joints, metallic bellows and aircraft components.

ADVERTISERS' INDEX

L

L & L Manufacturing Co. 81
Ledeen Mfg. Co. 13
Lincoln Machine Co., Inc. 132
Linear, Inc. 92
Logansport Machine Co., Inc. 55

M

Jas. P. Marsh Corporation 109
Marshalltown Mfg. Co. 133
Marvel Engineering Co. 51
M. C. Manufacturing Co. 102
Mead Specialties Co. 117
Mechanisms Inc. 133
Miller Fluid Power Division Flick-Reedy Corporation 82
Minnesota Rubber Co. 2
Modernair Corporation 130
Monsanto Chemical Co. Organic Chemical Division 29
Jas. A. Murphy & Company 122

N

National Seal Division Federal-Mogul-Bower Bearings, Inc. 10
New Products Corp. 134
Wm. W. Nugent & Co., Inc. 18
Numatics, Inc. 127

O

Oilgear Company 7
Ortman-Miller Machine Co., Inc. 23

P

Page Belting Co. 40
Palley Supply Co. 124
Pathon Mfg. Co. 93
William S. Pine 128
Plastic & Rubber Products Co. 103
Pneu-Trol Devices, Inc. 90
Power Jacks, Ltd. 117
Protective Closures, Inc. 79

R

Republic Manufacturing Co. 109
Roper Hydraulics, Inc. 42
Ross Heat Exchanger Div. American Standard 73
Ross Operating Valve Co. 9
Racine Hydraulics Inc. 15

S

A. Schrader's Sons Division of Scovil Mfg. Co. 35
Sealol Corp. 111
Sheffer Corp. 90
Snap-Tite, Inc. 59
Sonnet Tool & Mfg. Co. 114
Span Brass Manufacturing Co. 129
Sun Oil Company 89

T

TA Mfg. Corp. 119
Teer-Wickwire & Company Lindberg Air & Hydraulic Div. 129
Texas Company 60
Tog-Loc Inc. 49
Tomkins-Johnson Co. 21
Tru-Flate, Inc. 131
Tru-Seal Division Flick-Reedy Corporation 119
Tuthill Pump Company 37

U

Union Carbide Chemicals Co. Div., of Union Carbide Corp. 52
U. S. Electrical Motors, Inc. 53
U. S. Gasket Company Plastics Div. Garlock Packing Co. 54

V

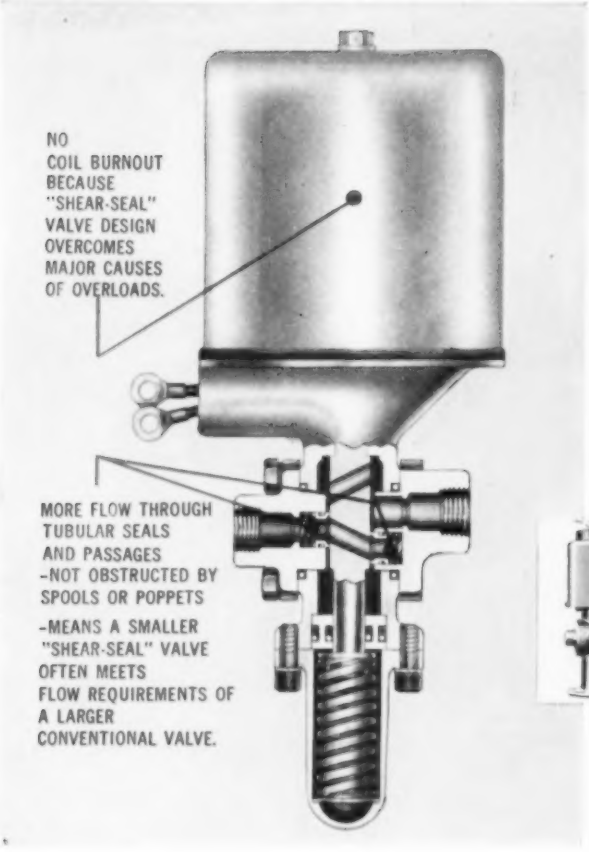
Van Products Co. 134
Versa Products Co., Inc. 131
Vickers, Inc. Division Sperry Rand Corp. Aero Hydraulics Division 105
Machinery Hydraulics Division 11
Vickers-Armstrongs Engineers Ltd. 85
Victor Equipment Co. 20
Henry Vogt Machine Co. 87

W

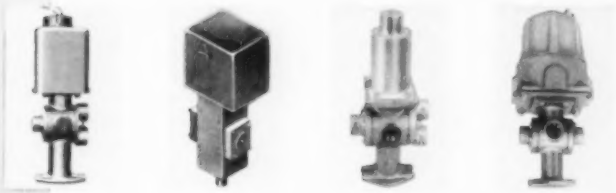
Waterman Engineering Co. 22
Watts Regulator Company 56
Weatherhead Company 97
Webster Electric Co. 25
Weldon Tool Co. 54
Westinghouse Air Brake Co. Industrial Products Division 115

LEAKPROOF at 3000 P.S.I.

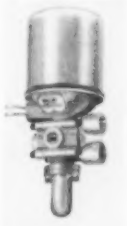
stop creeping cylinders!



STANDARD WHEREVER CLOSE LEAKAGE SPECIFICATIONS ARE VITAL: On hydraulic clamps of paper cutters, in propeller pitch control for ships, to lift rollers over seams in textile printing, in rocket charging, in nitrogen and freon charging (refrigeration coils, pressure bottle charging of insecticides and shave cream), as high pressure cut in on presses, on soaking pit doors and lift tables in steel mills, for airblast control on copper converters, on oil well blowout preventers, in test board applications, wherever a valve must be leakproof and stay leakproof.



250 P.S.I., 1000 P.S.I. and 1500 P.S.I. Air Valves; 250 P.S.I., 1500 P.S.I. and 3000 P.S.I. Oil and Water Valves; for A.C. and D.C. operation, Standard and Explosion-proof; Shut-off, Three-way, Four-way and diverter flow patterns.



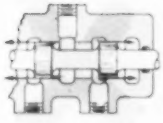
NO STICKING

because the movement of the sealing members does not depend on lubrication, the direct acting solenoid maintains a positive power margin.

LONG, MAINTENANCE-FREE SERVICE

is assured through the lapping action of the Shear-Seals against the slide, which actually improves the sealing qualities of the valve with each operation. The small amount lapped from the Shear-Seals after millions of cycles is compensated by a back-up spring. Dirt or pipe scale cause no damage or failure because the spring keeps the sealing surfaces in constant intimate contact.

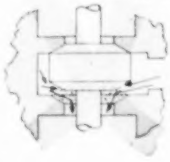
This is why we don't use



SPOOL VALVE DESIGN

They depend on leakage for lubrication, dirt can enter spool clearance, cause binding and coil burnout.

This is why we don't use



POPPET VALVE DESIGN

Dirt in fluid passes over sealing surfaces, acts like a sand blast quickly destroying sealing qualities.

Write for Catalog 58-59

barksdale valves CONTROL VALVE DIVISION

5125 ALCOA AVENUE • LOS ANGELES 58, CALIFORNIA

CIRCLE 15 ON TIME-SAVER CARD

Distilled Writing helps your ads win the fight for time

We're all fighting for busy readers' time. No man has time to read all the magazines that cross his desk; if he did, he'd never get his job done. And if your ad runs in a magazine that never gets read, it's money down the drain.

The Industrial Publishing Corporation developed Distilled Writing to help your ads win this fight for time. Distilled Writing is copy with the extra words squeezed out. All the facts are there, but each article gets only as much space as it *really needs* — not one line more! It's bright, clear and *concise.*

Result: Shorter, easier to read articles. More articles per issue in all ten IPC magazines. More subjects covered to attract readers and hold them. And this readership gives your ads a fighting chance.

He runs the only distillery in the business press

His name is David Kinsler (right). He distills writing. He works with all IPC editorial staffers — chief editors and junior associates alike — to make their material readable and worth reading . . . give readers more for their reading time.

Applied Hydraulics *The Magazine of Fluid Power*

812 HURON RD. • CLEVELAND 15, O. • SUperior 1-9622

New York 17, N. Y.
Rm. 836, 60 E. 42nd St.
Tel. Murray Hill 7-3420

Chicago 11, Ill.
Rm. 704,
520 N. Michigan Ave.
Tel. WHitehall 3-1655

Los Angeles 57, Calif.
Rm. 8,
672 S. Lafayette Park Pl.
Tel. DUnkirk 7-5104

London, England
John A. Lankester,
31 Palace St.
Westminster, S.W. 1

FC FRANCHISE CIRCULATION ®

Franchise Circulation gets magazines to the men who buy

DISTILLED WRITING

Distilled Writing gets magazines read